Prediction of difficulty in impacted lower third molars extraction; review literature

Maung Maung Latt[1], Pruedy Chewpreecha[2], Natthamet Wongsirichat[2]

[1] Master degree (International program) of Oral and Maxillofacial Surgery, Faculty of Dentistry, Mahidol University, Thailand.

[2] Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Mahidol University, Thailand.

Abstract

Surgical removal of impacted mandibular third molars can present with certain post-operative complications such as pain, swelling and trismus although the removal of these teeth is common minor surgical procedure. This review is intended to know the different aspects of the lower third molars impaction classifications and degree of difficulties in related articles. On the evaluation of radiographic images, we found that surgical difficulties in extracting impacted mandibular third molars can be expected on the basis of class 3, position C, bulbous and divergent roots or combination of all these factors. There was one limitation we found that curvature of root was not included in almost all difficulty indices. But it is still required to consider the other important factors, such as periodontal ligament width, soft tissue condition, patient characteristic, and clinician's experience. Further clinical studies should be conducted for new classification to get more reliable evaluation and more useful for daily practices.

Key words: mandibular third molars, impacted molars, classification, difficulty index, surgical removal

How to cite: Latt MM, Chewpreecha P, Wongsirichat N. Prediction of difficulty in impacted lower third molar extraction: Review literature. M Dent J 2015; 35: 281-90.

Corresponding author:
Natthamet Wongsirichat
Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Mahidol University
6 Yothi Road, Ratchathevi, Bangkok 10400, Thailand
E-mail: natthamet.won@mahidol.ac.th
Tel: 081-8305340

Received: 11 July 2015
Accepted: 1 September 2015

Introduction

Surgical extraction of impacted mandibular third molar is most common surgical procedure performed by oral and maxillofacial surgeon.[1] It usually comprises surgical trauma in highly vascularized area, mainly constituted by loose connective tissue, leading to expected inflammatory sequelae such as pain, swelling, trismus and general oral dysfunction during the immediate post-operative phase.[2] Impacted tooth is a tooth that is not allowed from erupting into dental arch within the estimated time because of malposition, lack of space or a physical barrier within the pathway of eruption.[3] According the **Elsey and Rock**, impaction of lower third molar is occurring up to 73% of young adults in Europe. Normally, lower third molar have been found to erupt within the ages of 17 and 24 year.[4,5] But eruption time of mandibular lower third molar varies with races, for example, eruption is as early as 14 year of age in Nigerians and up to 26 year in Europeans. The average of mandibular third molar eruption in male is approximately 3-6 months ahead of female and incidence of third molar impaction is higher in female. Impaction of mandibular is common condition associated with degree of extraction difficulties and risk of complications.[1] Oral surgeon can undertake correct management with minimal complication by assessing the difficulty of surgical procedure preoperatively.[6] This review is intended to know the different aspects of the lower third molars impaction classifications and degree of difficulties in related articles.

Clinical anatomy of impacted lower third molar

Lower third molar is situated at the distal end of the body of mandible, continuous with relatively thin ramus. This is region of weakness and fracture can also occur if excessive force will be applied during the impacted lower third molar elevation without adequate removal of surrounding bone.[2] The external oblique ridge strengthened the buccal plate; buccal alveolar bone in this region is thicker than the lingual. There is increased risk of lingual nerve damage using lingual split technique because lingual nerve is closed to the cortical plate.[3] Furthermore, in most cases, the root of mandibular third molar is close relationship to the mandibular canal that can cause the inferior alveolar nerve damage during surgery.[1]

Impacted mandibular third molars cause various problems, from pericoronitis and detrimental effects on mandibular second molars, to certain types of cysts or odontogenic tumours, and primary or secondary dental crowding.[7-10] These complications in the mandibular third molar eruption are attributable to their late formation and to the phylogenetic evolution of the mandible, which results in a lack of available space for normal eruption. Other causes for permanent third molar impaction include systemic factors like cleidocranial dysplasia, Down's syndrome, endocrine deficiencies (hypothyroidism and hypopitutarism), febrile diseases, and irradiation and local factors like malposed tooth germs, arch-length deficiency, supernumerary teeth, odontogenic tumours and abnormal path of eruption.[11]

Classification of impacted lower third molar

Systemic and meticulous classification of position of impacted third molar helps in accessing the best possible path of removal of teeth and also in encountered during removal. Prediction of operative difficulties before the extraction of impacted third molars allows a design of treatment that reduces the risks of complications. Both radiological and clinical information must be taken into account. Mostly used classifications are

(1) Based on nature of overlying tissues
(2) Winter's classification
(3) Pell and Gregory's classification

Based on nature of overlying tissue impaction, impacted lower wisdom teeth can be classified into-

(a) Soft tissue impaction- The height of the tooth's contours is above the level of the surrounding alveolar bone and then superficial portion is covered by soft (though this can be dense and fibrous) tissue. Soft tissue removal is the easiest type of tooth removal.

(b) Hard tissue (bony) impaction- this is where the wisdom tooth fails to erupt due to being obstructed by the overlying bone. This can be subdivided into partial and bony impaction.

Partial bony - the superficial part of the tooth is covered only by soft tissue but the height of the tooth contour is below the level of the surrounding alveolar bone. Apart from cutting the gingiva, possible bone removal from behind the tooth, the tooth's root may need to be divided.

Completely bony -the tooth is completely encased in bone so that when the gingiva is cut and reflected back, the tooth is not seen. Bone removal (large amount) together with root sectioning will be needed to remove the tooth. These are often the most difficult tooth to remove.[12]

Winter's classification

The classification is based on the inclination of impacted wisdom tooth (third molar) to the long axis of second molar.

Mesioangular-The impacted tooth is tilted towards second molar in the mesial direction.

Distoangular-The long axis of third molar is angled distally/posteriorly away from the second molar.

Horizontal -long axis of third molar is horizontal.

Vertical - long axis of third molar is parallel to the long axis of second molar.

Buccal/lingual obliquity - in combination with above, the tooth can be baccally (tilted towards cheek) or lingually (tilted towards tongue) impacted.

Transverse-the tooth is horizontally impacted but in cheek-tongue direction.

Inverse

Significance-Each type of impaction has some definite path of withdrawal of the teeth. Mesially impacted teeth are (can be) easier to remove whereas distally impacted teeth are (can be) hardest to remove. Bucally positioned maxillary (upper) teeth are easier to remove as the bone covering the tooth is thinner whereas the palatally positioned tooth requires bone removal and hence males the extraction difficult.[13]

Pell & Gregory's Classification

This is based on the relationship between the impacted lower wisdom tooth (3rd molar) to the ramus of the mandible (lower jaw) and the 2nd molar (based on the space available distal to the 2nd molar).

Class A The occlusal plane of the impacted tooth is at the same level as the occlusal plane of the 2nd molar. (The highest portion of impacted 3rd molar is on a level with or above the occlusal plane).

Class B The occlusal plane of the impacted tooth is between the occlusal plane & the cervical margin of the 2nd molar. (The highest portion of impacted 3rd molar is below the occlusal plane but above the cervical line of the 2nd molar). Class C The impacted tooth is below the cervical margin of the 2nd molar. (The highest portion of impacted 3rd molar is below the cervical line of the 2nd molar).

Class 1 There is sufficient space available between the anterior border of the ascending ramus & the distal aspect of the 2nd molar for the eruption of the 3rd molar.

Class 2 The space available between the anterior border of the ramus & the distal aspect of the 2nd molar is less than the mesio-distal

width of the crown of the 3rd molar. It denotes that the distal portion of the 3rd molar crown is covered by bone of the ascending ramus.

Class 3 The 3rd molar is totally embedded in the bone of the anterior border of the ascending ramus because of the absolute lack of space. It is obvious that Class 3 teeth present more difficulty in removal as a relatively large amount of bone has to be removed and there is a risk of damaging the ID nerve or fracturing the mandible (or both).[14]

Another system of measurement using an orthodontic protractor was incorporated to reduce errors arising from visual impression

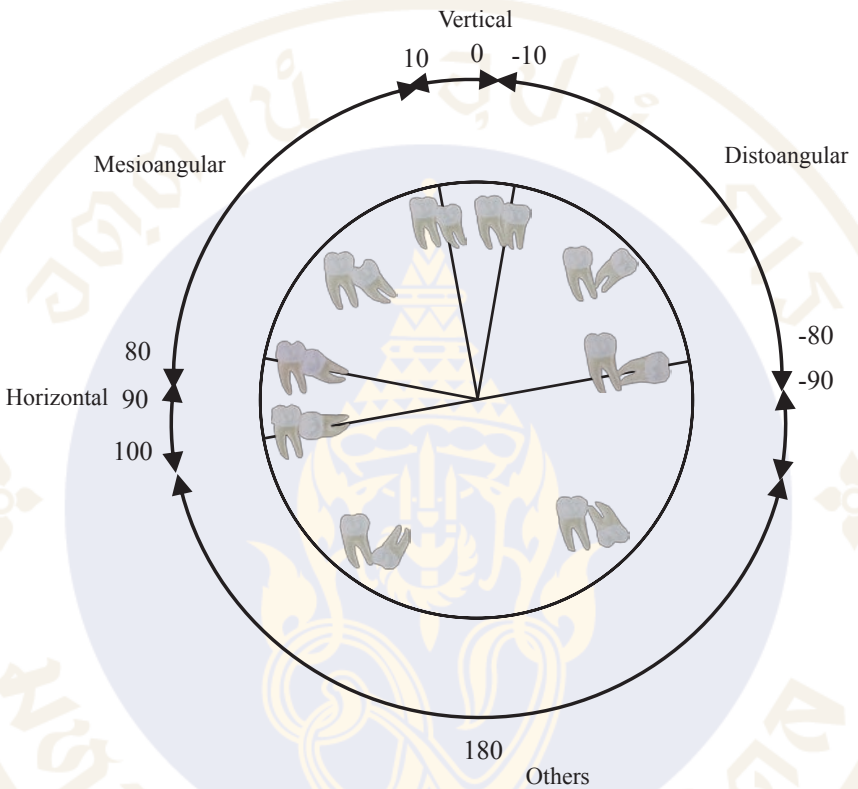

Figure 1 Classification of angulation of impaction.

Level A

Level B

Level C

Figure 2 classification of depth of impaction.

alone, was introduced by **Quek** et al.[15] in which the following classification was adopted for angulations (1) Vertical angulation: 0° to 10˚(2)Mesioangular impaction: 11˚to 79°(3) Horizontal impaction:80°to 100˚(4) Distoangular impaction:11°to 79°(5) Other:111°to 80°(6) Buccolingual impaction.

Regarding the depth of mandibular third molar the following classification was adopted (1) Level A: Not buried by bone. (2) Level B: Partially buried by bone (if any part of cement-enamel junction was lower than the bone level, the tooth was considered to be partially buried by bone.)(3) Level C: Completely buried by bone.

Difficulty indices for removal of impacted mandibular third molar

The difficulty index consists of three components:

1. Angulation of third molar in relation to the long axis of the second molar (mesioangular, distoangular, horizontal, etc.) according to Winter's classification.

2. Depth of the third molar in relation to the occlusal plane (classA,B,C)

3. Position of the mandibular third molar in relation to the vertical ascending ramus and the distal surface of the second molar (class I,II,III) according to Pell and Gregory classification.(11)

Pederson proposed a difficulty index for the removal of mandibular third molar. The total scores by which difficulty is judged are based mainly on local anatomy and radiographs.[16]

Pederson difficulty index is mainly based upon anatomical and radiographic features, including angulations, depth, and ramus relationship.[17] However, Pederson scale was tested by several studies and was claimed to be unreliable predictor of true difficulty.[18-19] Other studies were more comprehensive and took into consideration other variables than Pederson's ones such as abnormal root curvature, width of root, and number of roots.[16-21] Kharma have suggested new indices and claimed that their suggested criteria are more reliable and accurate than Pederson's scale. Kherma index included a new parameter and that was root morphology which it considers as significant predictor of surgical difficulty. The major difference of the new index and Pederson index is the incorporation of the root morphology which should be considered with any preoperative assessment and as a consequence the accuracy of prediction gets significantly better.

Postoperative assessment of the difficulty of each case was determined using Parant scale[9] which takes into account the technique required for surgical extraction as shown in table 2 and 3.[6]

Classification of mandibular third molar impaction and extraction difficulty degree enables the clinician to determine the difficulty in removal of the impacted tooth, to choose optimal treatment and to avoid the majority of possible complications. Juodzbalys and Daugela discovered that new mandibular third molar impaction and extraction difficulty degree classification based on anatomical and radiologic findings, describes wisdom tooth relation to the adjacent anatomical structures: mandibular ramus, second molar, alveolar crest, mandibular canal, and the spatial position of the tooth (table 4).

Yuasa at al. stated that difficulty extraction is associated with depth (depth is deep occlusal level: level C), ramus relationship/space available (ramus relationship/space available is no space: class3), width of root (the width of middle root is thicker than that of the neck and the roots do not separate, incomplete roots excluded: bulbous), or a combination of these factors.[3]

Table 1 Difficulty index for removal of impacted mandibular third molars (described by Pederson)

Classification	Value
Spatial relationship	
Meioangular	1
Horizontal/transverse	2
Vertical	3
Distoangular	4
Depth	
Level A: high occlusal level	1
Level B: medium occlusal level	2
Level C: deep occlusal level	3
Ramus relationship/space available	
Class1: sufficient space	1
Class2: reduced space	2
Class3: no space	3
Difficulty index	
Very difficult	7-10
Moderately difficult	5-6
Slightly difficult	3-4

Table 2 Kharma scale /relationship (position of mandibular third molars)

Mesioangular	0
Horizontal/transverse	1
Vertical	2
Distoangular	3
Depth	
Level A: high occlusal level	1
Level B: medium occlusal level	2
Level C: deep occlusal level	3
Ramus relationship/space available	
Class 1: sufficient space	0
Class 2: reduced space	1
Class 3: no space	2
Root form	
Convergent	0
Divergent	1
Bulbous	2
Difficulty index	
Very difficult	7-10
Moderately difficult	5-7
Slightly difficult	3-4
Easy	1-2

Table 3 Criteria of modified Parant scale

Easy I	Extraction requiring forceps only
Easy II	Extraction requiring osteotomy
Easy III	Extraction requiring osteotomy and coronal section
Easy IV	Complex extraction(roots section)

Table 4 Mandibular third molar impaction and extraction difficulty degree classification (by Juodzbalys and Daugela)

Position of mandibular third molar	Risk degree of presumptive intervention (score)			
	Conventional (0)	Simple (1)	Moderate (2)	Complicated (3)
Mesio-distal position in relation to the second molar-M and the mandibular ramus-R				
Relation to the second molar-M	Crown directed at or above the equator of the second molar	Crown directed below the equator to the coronal third of the second molar root	Crown/roots directed to the middle third of the second molar root	Crown/roots directed to the apical third of the second molar root
Relation to the mandibular ramus-R	Sufficient space in dental arch	Partially impacted in the ramus	Completely impacted in the ramus	Completely impacted in the ramus in distoangular or horizontal position
Apicocoronal position in relation to the alveolar crest-A and the mandibular canal-C(IAN injury risk)				
Relation to the adjacent alveolar crest (from the uppermost point of the tooth)-A	Tooth is completely erupted	Partially impacted, but widest part of the crown(equator)is above the bone	Partially impacted, but widest part of the crown(equator) is below the bone	Completely encased in the bone
Relation to the mandibular canal (from the lowest point of the tooth)	>=3mm to the mandibular canal	Contacting or penetrating the mandibular canal, wall of the mandibular canal may be identified	Contacting or penetrating the mandibular canal, wall of the mandibular canal is unidentified	Roots surrounding the mandibular canal
Bcccolingual position in relation to the mandibular lingual and buccal walls-B(LN injury risk)				
Relation to mandibular lingual and buccal wall	Closer to the buccal wall	In the middle between lingual and buccal wall	Closer to the lingual wall	Closer to lingual wall, when the tooth is partially impacted or completely encased in the bone(A2 orA3)
Spatial position-S				
Spatial position-S	Vertical (90˚)	Mesioangular<= 60˚	Distoangular>=120˚	Horizontal(0˚)or inverted(27˚)

Discussion

Since the extraction of mandibular third molars that are impacted or erupting in an abnormal position has been the first line of treatment[22,23,24], an assessment of the surgical difficulty in third molar surgery is fundamental to forming an optimal treatment plan. These surgical extractions are commonly performed both for prophylactic as well as for therapeutic purposes. Although their removal is a common minor oral surgical procedure, there are complications associated with it, like pain, swelling, trismus, alveolar osteitis and paraesthesia of the inferior alveolar nerve.[24,25]

In order to minimise number of complications during mandibular third molar extraction several classifications have been developed that are assessing the difficulty of surgical procedure and helping to create an optimal treatment plan. The most popular are Winter's[13] and Pell and Gregory's[14] systems who are classifying the inclinations and positions of the third molars based on the relation among the dental longitudinal axis, occlusal plane and ascending mandibular ramus. These systems have been extensively adopted and applied in clinical practice. However some authors claim that these scales have little value for predicting the degree of extraction difficulty,[19] mainly because these systems of classification introduce error of interpretation by the observer.[26]

Various indexes have been proposed and are used by clinicians to classify the difficulty of extraction of lower third molar. The Pederson index can be utilized for difficulty evaluation. However, it is not widely used because it often incorrectly identifies a case as difficult.[16] Kharma et al. developed the new index (scale) uses different important factors which are mentioned by different study such as tooth position, root number and morphology. All variables used in the new index are easily identifiable with orthopantomographs. In their study, Kharma et al stated that Pederson's index has showed poor correlation with both the proposed Kharma scale and the Parant scale. By contrast, the evaluation of Kharma scale, in terms of estimating preoperatively the difficulty of removal of impacted mandibular third molars with reference to postoperative difficulty indicated by Parant scale has showed a significant correlation.[6]

Khanal et al. recommended that, apart from the Difficulty Index score, other factors which can determine the difficulty index of the impacted tooth being extracted, like the **WHARFE** assessment(**W**inter classification, **H**eight of mandible, **A**ngulation of second molar, **R**oot shape and morphology, **F**ollicle development, Path of **e**xit of the tooth during removal)should also be taken into account, along with the length of time for removal of the teeth, the flap designs, the root anatomy and the surgeon's experience.[11]

In the preliminary study of Yuasa et. al., the analysis showed that it is important to have following information before extraction; relative depth, angulation and form of the root, number of roots, relationship of the tooth to ramus, proximity of the mandibular canal, lack of periodontal membrane space, position of the tooth in relation to the long axis of the second molar and relative horizontal position . But in their main study, they found that difficulty in extraction was associated with depth, ramus relation /space available, width of the root or combination of all these factors. They also said that their new index was significantly superior to conventional Pederson's index.[16] And they also said that there was one limitation in their research. It was the existence of an unpredictable factor such as abnormal root curvature that cannot be detected by panoramic radiograph.

There are some new approaches in assessing different anatomical and radiological parameters in Juodzbalys and Daugela's classification. For example, the depth of tooth impaction in Pell and Gregory's[14] classification was assessed according to the occlusal plane, but in some cases the crown of wisdom tooth is small in size and located below occlusal plane. However the tooth can be completely erupted and easily extracted. The assessment of tooth impaction (coronal position) should be evaluated from the alveolar crest, because the extraction difficulty is determined predominantly by the depth of impaction in the bone. Furthermore, it is necessary to highlight the lower landmark of the possible apico-coronal wisdom tooth position which is determined by mandibular canal. It was mentioned that the proximity of the mandibular third molar to the mandibular canal is considered a risk factor for damage to the inferior alveolar nerve.[3]

In conclusion, we found that surgical difficulties in extracting impacted mandibular third molars can be expected on the basis of class 3, position C, bulbous and divergent roots or combination of all these factors on the evaluation of radiographic images. We should also consider another risk factor that is the proximity of the mandibular third molar to the inferior alveolar nerve. This factor was included in the Juodzbalys and Daugela's new classification. All the classifications proposed based on anatomical and radiological impacted mandibular third molar features is promising to be a helpful tool for impacted tooth assessment as well as for planning for surgical operation. But it is still required to consider the other important parameters, such as periodontal ligament width, soft tissue condition, patient characteristic, and clinician's experience. Further clinical studies should be conducted for new classification to get more reliable evaluation and more useful for daily practices.

Funding: None
Competing interest: None
Ethical approval: None

References

1. Susarla SM, Blaeser BF, Magalnick D. Third molar surgery and associated complications. ***Oral and maxillofacial surgery clinics of North America***. 2003; 15: 177-86.
2. Majid O MW. Use of dexamethasone to minimise post-operative sequelae after third molar surgery: comparison of five different routes of administration. ***Oral Surg*** 2013.ISSN 1752-2471
3. Juodzbalys G, Daugela P. Mandibular third molar impaction: review of literature and a proposal of a classification. ***J Oral Maxillofac research***. 2013; 4: e1.
4. Elsey MJ, Rock WP. Influence of orthodontic treatment on development of third molars. ***The Br J Oral Maxillofac Surg***. 2000; 38: 350-3.
5. Pahkala R, Pahkala A, Laine T. Eruption pattern of permanent teeth in a rural community in northeastern Finland. ***Acta odontologica Scandinavica***. 1991; 49: 341-9.
6. Kharma MY, Sakka S, Aws G, Tarakji B, and Nassani MZ. Reliability of Pederson Scale in Surgical Extraction of Impacted Lower Third Molars: Proposal of New Scale. J Oral Dis.20ly ID157523
7. Kay LW, Killey HC. The extraction of teeth. The impacted third molar. ***Dental update***. 1976; 3: 49-52.
8. Blondeau F, Daniel NG. Extraction of impacted mandibular third molars: postoperative complications and their risk factors. ***J Can Dent Assoc*** 2007; 73: 325.
9. Chiapasco M, DeCicco L, Marrone G. Side effects and complications associated with third molar surgery. ***Oral Surg Oral Med Oral Pathol*** 1993; 76: 412–20.
10. Raghoebar GM, Boering G, Vissink A, Steganga B. Eruption disturbances of permanent molars: a review. ***J Oral Pathol Med***. 1991; 20: 159–66.
11. Khanal P, Dixit S, Singh R, Dixit P. Difficulty index in extraction of impacted mandibular third molars and their post-operative complications. ***Journal of Kathmandu Medical College***, 2014, 3: 14-20.

12. Peterson LJ EEl, Hupp JR, Tucker MR. Principles of management of impacted teeth. In: Peterson LJ, Ellis E III, Hupp JR, Tucker MR, eds. ***Contemporary Oral and Maxillofacial Surgery***,. Mosby Inc, St. Louis 1998.
13. Winter G. ***Impacted Mandibular Third Molar.*** St Louis, American Medical Book Co. 1926.
14. Pell GJ GB. Impacted mandibular third molars: classification and modified techniques for removal. ***Dent*** 1933; 39: 330-8.
15. Quek SL, Tay CK, Tay KH, Toh SL, Lim KC. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. ***Int J Oral Maxillofac Surg***. 2003; 32: 548-52.
16. Yuasa H, Sugiura M. Clinical postoperative findings after removal of impacted mandibular third molars: prediction of postoperative facial swelling and painbased on preoperative variables. ***Br J Oral Maxillofac Surg***. 2004; 42: 209-14.
17. Peterson LJ. "Principles of management of impacted teeth," in ***Contemporary Oral and Maxillofacial Surgery***, Peterson LJ, Ellis E, Hupp JR, Tucker MR. Eds., Mosby, Chicago, III, USA, 4th ed 2003.
18. Diniz-Freitas M. Lago-M'endez L, Gude-Sampedro F, Somoza-Martin JM, G'andara-Rey JM. Garc´ıa-Garc´ıa,"Pederson scale fails to predict how difficult it will be to extract lower third molars," ***Br J Oral Maxillofac Surg*** 2007; 45: 23–26.
19. García AG, Sampedro FG, Rey JG, Vila PG, Martin MS. Pell-Gregory classification is unreliable as a predictor of difficulty in extracting impacted lower third molars. ***Br J Oral Maxillofac Surg*** 2000; 38: 585-587.
20. O. M. Gbotolorun, G. T. Arotiba, and A. L. Ladeinde, "Assessment of factors associated with surgical difficulty in impacted mandibular third molar extraction," ***J Oral Maxillofac Surg*** 2007; 65: 1977-83.
21. MacGregor AJ. ***The Impacted Lower Wisdom Tooth***, Oxford University Press, Oxford, UK, 1985.
22. Dachi SF, Howell FV. A survey of 3874 routine full mouth radiographs. A study of impacted teeth. ***Oral Surg*** 1961; 14: 1165–9.
23. American Association of Oral and Maxillofacial Surgery. Impacted teeth. ***Oral Health*** 1998; 88: 31-2.
24. Sisk AL, Hammer WB, Shelton DW, Joy ED Jr. Complications following removal of impacted third molars; the role of the experience of the surgeon. ***J Oral Maxillofac Surg*** 1986; 44: 855–9.
25. Bui Ch, Seldin EB, Dodson TB. Types, frequencies and risk factors for complications after third molar extraction. ***J Oral Maxcillofac Surg*** 2003; 61: 1379–89.
26. Almendros-Marqués N, Berini-Aytés L, Gay-Escoda C. Evaluation of intraexaminer and interexaminer agreement on classifying lower third molars according to the systems of Pell and Gregory and of Winter. ***J Oral Maxillofac Surg***. 2008; 66: 893-9.