Review Article

# Impacted Mandibular Third Molars: Review of Literature and a Proposal of a Combined Clinical and Radiological Classification

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## Abstract

Tooth impaction is a pathological situation where a tooth fails to attain its normal functional position. Impacted third molars are commonly encountered in routine dental practice. The impaction rate is higher for third molars when compared with other teeth. The mandibular third molar impaction is said to be due to the inadequate space between the distal of the second mandibular molar and the anterior border of the ascending ramus of the mandible. Impacted teeth may remain asymptomatic or may be associated with various pathologies such as caries, pericoronitis, cysts, tumors, and also root resorption of the adjacent tooth. Even though various classifications exist in the literature, none of those address the combined clinical and radiologic assessment of the impacted third molar. Literature search using the advanced features of various databases such as PubMed, Scopus, Embase, Google Scholar, Directory of Open Access Journals and Cochrane electronic databases was carried out. Keywords like impaction, mandibular third molar, impacted mandibular third molar, complications, anatomy, inferior alveolar nerve injury, lingual nerve injury were used to search the databases. A total of 826 articles were screened, and 50 articles were included in the review which was obtained from 1980 to February 2015. In the present paper, the authors have proposed a classification based on clinical and radiological assessment of the impacted mandibular third molar.

**Keywords:** Classification, Complications, Impacted tooth, Management, Third molar

## Introduction

Impacted tooth is a tooth which is completely or partially unerupted and is positioned against another tooth, bone or soft tissue so that its further eruption is unlikely, described according to its anatomic position.[1] The third molar impaction is occurring in about 73% of the young adults in Europe,[2] these teeth generally erupt between the ages of 17 and 21 years.[3] It has also been reported that the third molar eruption varies with races, such as in Nigeria[4] mandibular third molars may erupt as early as 14 years and in Europe[5,6] it may erupt up to the age of 26 years. Factors such as the nature of the diet that may lead to attrition, reduced mesiodistal crown diameter, degree of use of the masticatory apparatus and genetic inheritance also affect the timing of third molar eruption.[7] Most of the researchers suggest that the females have a higher incidence of mandibular third molar impaction when compared to males.[8,9]

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## Methods of Literature Search

A web-based literature search using the advanced features of various databases such as PubMed, Scopus, Embase, Google Scholar, Directory of Open Access Journals (DOAJ), and Cochrane electronic databases was carried out. The major MeSH and other keywords like impaction, mandibular third molar, impacted mandibular third molar, complications, anatomy, inferior alveolar nerve injury, lingual nerve injury were used to search the databases. The search encompassed articles published from 1980 to February 2015, and the search was limited to articles published in English language. A total of 826 articles were screened, and 50 articles were included in the review.

## Causes of Impacted Teeth

Various causes have been suggested in the literature for the impaction of the third molar. It has been suggested that the

gradual evolutionary reduction in the size of the human mandible/maxilla has resulted in too small mandible/maxilla that may accommodate the corresponding molars.[10] It has also been found that the modern diet does not offer a decided effort in mastication, resulting in loss of growth stimulation of jaws, and thus the modern man has impacted and unerupted teeth. It has been suggested that the major basic cause of aberrant/impacted teeth in the adults of Western Europe, Great Britain and Ireland, U.S.A, and Canada is due to artificial feeding of babies, the habits developed during childhood, due to cross breeding, more consumption of sweet food by the children and youth which produces disproportion in the jaws and thus the teeth.[2,11]

## Classification

### The first classification for the impacted molar

- Vertical (38%)
- Mesioangular (43%)
- Horizontal (3%)
- Distoangular (6%)
- Buccoangular
- Linguoangular
- Inverted
- Unusual.[12]

### Pell and gregory

#### *Relation of the tooth to ramus of mandible and second molar*

- Class I: Sufficient amount of space for accommodation of the mesiodistal diameter of the crown of the third molar
- Class II: The space between the ramus and distal side of second molar that is, less than the mesiodistal diameter of the third molar
- Class III: All/most of the third molars is located within the ramus.[13]

#### *Relative depth of the third molar in the bone*

- Position A: The highest portion of the tooth is on a level with/above the occlusal line
- Position B: The highest portion of the tooth is below the occlusal plane, but above the cervical line of the second molar
- Position C: The highest portion of the tooth below the cervical line of the second molar teeth in relation to the long axis of impacted second molar.

### According to nature of overlying tissue

This system is used by most dental insurance companies and one by which surgeon charges for his services.

- Soft tissue impaction
- Partial bony impaction
- Fully bony impaction.[14]

## Pathological Changes Associated with Impacted Third Molars

The retained, unerupted mandibular third molars are often associated with varied pathologies which are listed in Table 1.

### Pericoronitis

Many studies have looked at the association of pericoronitis and third molar impaction, and this is still the main cause for extraction of these teeth. However, one of the major flaws in these studies is the fact that there is no standard definition of pericoronitis. The eruption process is also likely to cause minor gingivitis, where the symptoms may be similar to pericoronitis, and the lack of a good definition for this disease may lead researchers and clinicians to misclassify it. Still pericoronitis is undoubtedly the main problem faced by dentists when it comes to lower impacted third molars.[10,12,15]

### Dental caries

The impacted lower third molars are extracted more commonly also due to dental caries, involving either the impacted third molar itself or the distal surface of the second molar. Majority of the researches in this context were carried out in patients who were referred for third molar removal and hence, the actual incidence of this disease in the general population

**Table 1: Classification of pathologies associated with impacted mandibular third molars**

| |
|---|
| Clinical signs and symptoms |
| Caries |
| Pain |
| Swelling |
| Paresthesia |
| Periodontal pocket |
| Pericoronitis |
| Noninflammatory radiological changes |
| Caries |
| Root resorption (internal or external) |
| Interdental bone loss |
| Hyperplastic dental follicle |
| Mild inflammatory radiological changes |
| Pericoronal radiolucent areas suggesting pericoronitis |
| Periapical radiolucent areas suggesting abcess |
| Severe inflammatory radiological changes |
| Osteomyelitis |
| Radiological signs of cysts and benign tumors |
| Dentigerous cyst |
| Keratocystic odontogenic tumor |
| Odontomes |
| Ameloblastoma |
| Odontogenic fibroma |
| Radiological signs of malignant tumors |
| SCC |
| Fibrosarcoma |
| Mucoepidermoid carcinoma |

SCC: Squamous cell carcinoma

cannot be estimated.[16-18] According to Nordenram *et al*.[19] caries accounts for 15% of third molar extractions. Researchers in prospective studies of occlusal caries in patients with asymptomatic third molars reported an increased frequency of caries with an increase in age and erupted third molars.[20,21]

### Cysts and tumors associated with the tooth

Odontogenic cysts and tumors may be observed in some patients with impacted third molars, although they are relatively rare.[21] The incidence of large cysts and tumors occurring around impacted third molars differs greatly in various studies, showing a wide range from 0.001% when a biopsy was indicated to 11% when the diagnosis was clinically established.[19,22] This wide variation indicates that the presence of a cyst is a weak indication for prophylactic extraction of impacted third molars. Cystic changes may be encountered in the histopathological examination of the associated soft tissue of the asymptomatic impacted third molars, commonly in patients older than 20 years. The incidence, multiple presentation, and recurrence of aggressive cysts of the jaws and the malignant transformation of cysts have been discussed by Stoelinga and Bronkhorst.[23]

### Periodontitis

The incidence of periodontitis has been reported to vary from 1% to 5% on the distal surface of the second molar. The incidence and prevalence of periodontitis increases with age irrespective of the presence or absence of the third molars, and thus a higher incidence of periodontitis has been observed among the older patients in relation to the impacted wisdom teeth. There is a paucity of studies relating periodontitis associated with impacted third molars with oral hygiene, which may be a confounding factor.[10,22]

### Root resorption

It has been shown in some studies that a third molar left *in situ* may cause resorption of the distal root of the adjacent second molar. Some studies have also reported an association between root resorption at the apex and increasing age. However, these studies do not represent the incidence of this problem in the general population since these are retrospective studies and are carried out in secondary care settings.[10,12,15]

## Late Crowding in Lower Incisors

One major controversy for indicating the prophylactic removal of lower third molars is the belief that their presence may result in late crowding of the lower incisors. However, it has been observed in a randomized controlled trial that the presence of impacted third molars had no significant clinical influence on the development of crowding in the lower incisors. Previous studies support these findings and suggest that crowding may be caused by other factors.[24,25] A review of studies related to management of third molars by orthodontists suggested that the role of third molars may be controversial in the alignment of the anterior teeth and that no evidence exists in support of the fact that third molars may cause late incisor crowding.[26]

### Other related pathologies

One of the most commonly reported pathologies is an association of pain directly related to the presence of a third molar. The prevalence of this condition varies greatly from 5% to 53%. The incidence of cellulitis and osteomyelitis has been reported to be around 5%. Few other conditions which are also believed to be associated with impacted third molars include functional disorders such as occlusal interference, cheek biting, mastication disorders, trismus and temporomandibular joint problems.[9,15] These pathologies and symptoms may result in distress and pain, but their correlation with third molars is not yet well-established due to lack of supporting evidence from the current literature.

Studies have shown that smoking causes pathological diversity, by augmenting expression of epidermal growth factor receptor and it has been suggested that this observation should be taken into account when deciding in case of removal of an asymptomatic impacted lower third molar. Ki67 and p53 are two markers which are commonly used to assess the pathologic proliferation and early-stage tumoral alterations in vital tissues. Results of recent studies shown that dental follicles of smokers have higher Ki67 and p53 protein expressions than nonsmokers' follicles.[27-29]

## Assessment of Third Molar

Assessment of impacted tooth is done by physical and radiographic evaluation. The physical evaluation includes inspection and palpation of the temporomandibular joint and movement of the mandible, determination of mobility characteristics of lips and cheeks, size and contours of the tongue and appearance of soft tissue overlying the impacted teeth. Radiographic evaluation includes assessment of root morphology, size of follicular sac, density of the surrounding bone, contact with the second molar, nature of overlying tissues, inferior alveolar nerve and vessels, relationship to body and ramus of mandible, relation with adjacent teeth and buccal to lingual position of the third molar.[30]

Haghanifar *et al*. have been carried out a study to find feasible radiographic criteria to help differentiate between normal and pathological dental follicles. The authors found that the average diameter of teeth associated with cystic follicular tissue was slightly more than the normal teeth; therefore, the average diameter of the follicles of these teeth was also slightly more than the normal follicles. Neither of the samples showed statistical significant differences but the probability of cystic epithelial changes thought to be increased when the dental follicles were noticed with the unusual wider surface. The results of the study concluded that the ratio of dental follicle diameter to the mesiodistal width of the teeth cannot be practicable as a diagnostic index to differentiate between normal and pathological dental follicle.[31]

## Management of Impacted Tooth

The treatment plans depend on the presenting complaint and the history of the patient, the physical evaluation, radiographic assessment, the diagnosis, and the prognosis. The management includes observation, exposure, transplantation or removal of the impacted tooth

### Observation

If the impacted mandibular third molar is embedded in bone with no perceptible to the follicle, as may be seen in an older individual and has no history, signs of associated pathology, long-term observation is appropriate. Most impacted teeth retain an erupting potential, and annual/biannual evaluation would be recommended if no indications for direct surgical management arise.

### Exposure

This option is considered if there is probability that it may erupt into useful occlusion but is obstructed by follicle, sclerotic bone, hypertrophic soft tissue, odontoma, etc., If the second molar is absent, exposure of a blocked third molar may be considered.

### Transplantation of mandibular third molar

The variety of crown and root shape on the impacted third molar make them suitable for transplantation to other molar sites, bicuspid and even the cuspid locations depending on the anatomy of the coronal and radicular surface.

### Removal

The primary reasons to remove impacted teeth are to correct associated pathology and to intercept reasonably expected pathological process.[22]

## Indications for Mandibular Third Molar Extraction

As mentioned earlier, the third molar teeth are the last to erupt with a relatively high chance of becoming impacted. Hence, the surgical extraction of these impacted teeth has become the most common dentoalveolar surgeries.[14] In 1979, the National Institutes of Health Consensus Development Conference agreed on a number of indications for removal of impacted third molars, which included infection, nonrestorable carious lesions, cysts, tumors, and destruction of adjacent teeth and bone.[30] Some authors reported the absence of any associated problems over a period of several years due to the impacted third molars in edentulous patients.[32] However, overemphasizing the development of dentigerous cysts due to impacted third molars have also been reported in the literature.[33]

The removal of impacted third molars is indicated for various therapeutic and prophylactic measures. However, no general indication has been agreed upon till date for the need of surgical removal of all asymptomatic impacted third molars.[18,34] The surgical extraction of many impacted mandibular third molars which have been asymptomatic for years are often carried out to prevent the development of any future complications and pathologic conditions.[35] Many investigators have questioned the necessity of removal for patients who are asymptomatic or have no associated pathologies, based on the view that retention of impacted teeth for a longer duration has less chances of pathological change in the tooth itself, or of deleterious effects on adjacent tooth and associated structures. Few authors have argued over the fact that all impacted third molars should be removed regardless of being asymptomatic; while others suggest that removing such impacted asymptomatic third molars is questionable in the light of the present lack of knowledge about the incidence of associated pathology.[18,22,36,37] Yet another group of authors considers that prophylactic surgical removal of impacted third molars is not necessary as the risk of development of pathological conditions in or around follicles of third molars is apparently low.[38]

Extraction of the impacted mandibular third molars significantly improved the periodontal status on the distal aspect of second molars, positively affecting the overall health of supporting periodontal tissues.[39] But it is also suggested that periodic exercising of arbitration to enhance the periodontal parameters on the distal surface of the second molar at the time of third molar extraction is not advisable for all subjects.[40-42]

The removal of asymptomatic impacted third molars that could not cause any complications for a known period of time thought to be an encumbrance from economic standpoint. The assessment of health risks and cost effectiveness regarding the prophylactic extraction of asymptomatic impacted third molars should be considered before tooth removal.[43] The dental practitioner, who scrutinize the healthy individual should monitor carefully regarding the pathologies which may incur an impacted third molar. He should procreate adult patients with asymptomatic third molars, fathom that there is no coercion or it is indispensable to remove the impacted third molars without any pathology. This aforesaid phenomenal proposition needs to be exercised for adolescents and their parents regarding the impact of the extraction of asymptomatic impacted third molar removal on lower incisor crowding at a later period.[44]

## Complications and Risks Following Surgery

Complications associated with the removal of impacted teeth are relevant and is aided by local and general factors which include tooth position, age of the patient, health status, knowledge and experience of the dental surgeon, and surgical equipment used. Most common complications associated with the removal of the third molar include damage of the pain, sensory nerve leading to paresthesia, dry socket, infection, and hemorrhage. Severe

**Table 2: Proposed classification (Dr. Santosh Patil classification) for impacted mandibular third molars**

| Class | Description |
|---|---|
| I | No pathology associated |
| II | Only clinical signs and symptoms |
| III | Class II features with noninflammatory radiological changes |
| IV | Class III features with mild inflammatory radiological changes |
| V | Class IV features with severe inflammatory radiological changes (osteomyelitis) |
| VI | Class V features with radiological signs of cysts and benign tumors |
| VII | Class VI features with malignant radiological signs of tumors |

trismus, oro-antral fistula, buccal fat herniations, iatrogenic damage to the adjacent second molar, and iatrogenic mandibular fracture may also occur, though very rarely.[38,45] The rate of sensory nerve damage after third molar surgery ranges from 0.5% to 20%.[28,46] The overall rate of dry socket varies from 0% to 35% among studies.[38,47] The risk of dry socket increases with lack of surgical experience and tobacco use though this does not justify prophylactic removal. Many of these problems are not permanent; however, paresthesia may become permanent and lead to functional problems in some cases.[48,49] The pathological features associated with impacted third molars are summarized in Table 1, after a thorough review of the literature. According to these features, an attempt has been made to propose the first combined clinical and radiological classification of impacted mandibular third molars [Table 2]. This attempt of proposing the classification will assist the dental practitioners and researchers in accomplishing insight in terms of standardized assessment and categorization of impacted mandibular third molar which will further help in the management of this condition accordingly. This classification would expedite continued studies to be carried and analogizing to be made in a more categorical and propitious manner and allow an exceptional understanding of the pathophysiology underlying the impacted teeth. This proposed classification focus on diversified key characteristics that are believed to be of concernment to the dental practitioners and have also been hypothesized by others as important when it comes to various sequel of interest such as practice efficiency, operator satisfaction, and subject outcomes. It also provides a common lexicon and nomenclature for referring to group practices of different kinds and also serves common terminology to facilitate transmission among practitioners, researchers, academicians, and patients.

It is also implied that additional clinical research should be conducted for the substation and affirmation of the classification and also to know the authenticity of this proposed neoteric classification.

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