



**PERIODONTITIS OF 2<sup>nd</sup> MOLAR AS A REPERCUSSION OF IMPACTED LOWER THIRD MOLAR EXTRACTION: A REVIEW**

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**ABSTRACT**

Various symptoms may arise after the removal of lower 3<sup>rd</sup> molar; such as formation of periodontal pocket, periodontal attachment-loss, bone resorption and even mobility of the adjoining molar tooth. Current periodontal conditions, age of the patient, type of the impaction; all of these factors will determine the severity of the defect. Several recent studies give the impression that the surgeon can bring down the risk of periodontal degradation of the distal aspect of second molar through adequate preoperative assessment, reasonable selection of flap design, by proper instrumentation and selecting the correct suture type as well as administering certain mandatory postoperative interventions. The aim of this review article is to highlight the ramifications of extraction of the impacted third molar over the periodontal status of distal aspect of 2<sup>nd</sup> molar and discuss the methods to minimize it.

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**INTRODUCTION**

Of all incidences of impacted teeth, mandibular third molar impactions are the most common cases with the highest incidence rate of 66-77%.<sup>1</sup> Third molar extraction becomes a necessity if there is recurrent peri-coronal infection, presence of carious lesion at the adjoining 2<sup>nd</sup> molar, risk of root resorption of the 2<sup>nd</sup> molar due to un-erupted third molar, and in some instances, certain TMJ disorders may also indicate removal of the third molars.<sup>2</sup> Some experts also propose a possibility of development of anterior crowding due to pressure exerted by an un-erupted third molar. The third molar even can be prophylactically removed if found to be inclining mesially towards the 2<sup>nd</sup> molar.<sup>3</sup> Searching from the recent literature, it has become evident that there are certain destructive effects on the periodontium of the 2<sup>nd</sup> molar upon extraction of third molar. So, prior to condemning a tooth to extraction, the oral surgeon must consult with a periodontist to evaluate the chances of iatrogenic damage to the periodontium of the second molar. The periodontist should examine clinically as well as radiographically to evaluate the upcoming issues at the 2<sup>nd</sup> molar region and if such a scenario happens, the extent or degree of periodontal destruction should also be pre-determined.

If periodontal complications of 2<sup>nd</sup> molars need to be minimized, certain precautionary measures have to be taken from the very initial level. These can be described as:

1. Thorough pre-operative periodontal evaluation
  2. Judicious flap design following periodontal considerations
  3. Selection of appropriate suture material
  4. Proper post operative care
- While selecting the design of the flap, pre-consultation with a periodontist is a must.
  - Using best instruments to minimize any trauma to the adjacent tooth.
  - Selecting appropriate suture material,
  - As well as, adequate post-operative interventions should be followed.

In this review, all these precautionary measures will be discussed one by one in detail.

**Assesment at pre-operative level**

Pre-operative assessment is crucial before extracting any tooth, but when it comes to 3<sup>rd</sup> molar extraction, it's an extremely important prerequisite. The statement is often made, "do not operate on a stranger". This step basically allows for taking a detailed medical and dental history and appropriate intra-oral

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examinations both clinically and radiographically. This stage of evaluation consists of various steps, like:

1. Analysing status of the periodontal tissue,
2. Patient's age,
3. Properly categorizing the impaction type.

**Analysing the status of the periodontal tissue:** It's a well-known fact that, the pre-operative periodontal status of the 2<sup>nd</sup> molar, decides the post-operative periodontal sequelae for the 2<sup>nd</sup> molar. So before extracting the impacted 3<sup>rd</sup> molar, a thorough periodontal check-up needs to be carried out, which includes:

1. A detailed evaluation of Medical and Dental history and assessment of comorbidities,
2. Clinical as well as radiographic evaluation of the prospective surgical site,
3. Examining the presence of any intrabony defects or deep periodontal pockets,
4. Evaluating the tendency of the site for plaque accumulation /Debris retention,
5. Searching for any history of recurrent inflammation of interdental gingiva adjacent to the 2<sup>nd</sup> and third molar.

Kugelberg *et al*<sup>4</sup> had already shown in their study that, the size of the distal bone defect of the second molar after impacted 3<sup>rd</sup> molar extraction, is related to the pre-operative periodontal status. Passarelli *et al*<sup>5</sup> also stated that, compared to non-periodontitis patients, the patients with periodontitis history have 41 times more probability of getting periodontal disease after this extraction surgery.

**Age of the patient:** Extraction of an impacted 3<sup>rd</sup> molar becomes progressively difficult with increasing age. It could be attributed to the following reasons:

1. Progressive thinning of the periodontal ligament with increasing age,
2. Reduction of the periodontal space,
3. Increased incidences of ankylosis within the bone,
4. Root formation being an ongoing process, the tooth length increases till 25 years of age, making the extraction progressively difficult
5. Increasing brittleness of the mandibular bone with progressing age. (Many studies suggested that the best extraction period is before the age of 25. Because, after 25 years of age, the complications increase significantly).<sup>7</sup>

**Type of the impaction:** Third molars are classified according to their inclination to the long axis of the second molar. According to Winter's Classification, impacted 3<sup>rd</sup> molars can be classified into: (1) Vertical angulation, (2) Horizontal angulation, (3) Disto-angular (4) Mesio-angular (5) Transversal angulation, and (6) inverse angulation.<sup>8</sup> According to Kim *et al*<sup>9</sup>, the incidence of distal alveolar bone loss in the adjacent second molars is closely related to the type of third molar impaction. The research by Kugelberg *et al*<sup>10</sup> showed that the type of impacted third molars that are most likely to form periodontal pockets and bone defects in the distal part of the second molars is the "Mesial impaction", followed by the horizontal impaction, and the vertical impactions are the lowest in numbers.<sup>11</sup> Due to the local topographic considerations and resulting compromise in oral hygiene

methods, mesial or horizontal impacted teeth showed an increased accumulation of plaque microorganisms, followed by the formation of periodontal pockets and alveolar bone loss<sup>12</sup> in the distal aspect of adjacent second molars.

Pre-operatively, the partially erupted mandibular third molars are responsible in creating a compromised periodontal status at the distal aspect of the 2<sup>nd</sup> molar, however, the cases where a completely impacted third molar is considered, it represents an entirely different scenario. The cases where the third molar is in: a) a complete bony impaction or b) a complete mucosal impaction, the pre-operative periodontal status of the distal aspect of the 2<sup>nd</sup> molar is relatively healthy. However, in such cases, the incidences of post-operative development of periodontal defects were more.

Nunn *et al*<sup>13</sup> found that, after removal of an Impacted lower third molar, there was a significantly increased risk of developing a periodontal in case of submucosal impaction compared to a complete impaction, with a 4.8-fold increase after submucosal impacted lower third molar removal and only a 1.7-fold increase after completely impacted 3<sup>rd</sup> molar removal.

Completely Impacted lower third molar removal usually has only buccal defects, while the mucosal type of impaction already has a coronal bone wall missing, and the buccal bone wall usually needs to be partially removed intraoperatively. Especially in the coronal plane, this extraction procedure is in close contact with the second molar, and there is no obvious bone boundary, which will cause greater defects in the distal aspect of the second molar.<sup>14</sup>

To conclude, the following conditions predispose to post operative periodontal involvement of 2<sup>nd</sup> molar:

1. Mesially or horizontally impacted mandibular third molars.
2. Subject age more than 25 years
3. Preoperative probing depth and attachment loss exceeding 7mm and 6mm respectively
4. Patients with pre-existing periodontal inflammation, poor oral hygiene as well as a high plaque score

#### **Intraoperative Measures**

Flap design, bone removal and the suture material and technique may affect the periodontal health of the distal aspect of the second molar after extraction of the impacted 3<sup>rd</sup> molar. Various techniques have been suggested to counter these destructive effects, such as

1. Modification of the flap design
2. Specific instrument for bone removal and tooth sectioning
3. Different suturing techniques

**Design of the flap:** After Impacted lower third molar surgery, an important factor affecting the periodontal healing of second molars is the remaining amount of periodontal ligaments and gingival fibres at the surgical site.<sup>15</sup> In the case of a thin gingival biotype, the design of the standard flap may lead to attachment loss and periodontal pockets formation at the second molar area.<sup>16</sup> The modified design of conventional flaps, such as triangular, Szmyd and envelope flaps, which moved 1–2mm inferior to the standard incision line that preserves the periodontal ligament adjacent to the second molar and the attached gingiva to the buccal surface can

reduce potential periodontal complications of the adjacent second molars.<sup>17</sup> From various studies, it can be said that, it takes nearly 3 months to heal the periodontium at the distal aspect of the 2<sup>nd</sup> molar after this surgery. But, compared with the triangular flap design, the Szmyd flap and the modified flap are more beneficial to periodontal health, while the triangular flap design is better than the envelope flap.

**Modification in using different instruments:** Chisel and mallet were the traditional third molar extraction tools used to remove bone and split the tooth. Such instruments used to create an unpredictable degree of bone destruction and inevitable postoperative trauma.<sup>18</sup> With the development of minimally invasive concept, minimally invasive tooth extraction instruments, including ultrasonic bone knife, 45° contrast-angle turbine hand piece, elongated impacted tooth bur, modified minimally invasive dental elevator, and buccal retractor, has widely been used.<sup>19</sup>

Wang *et al*<sup>20</sup> compared the alveolar bone healing after traditional bone removal and minimally invasive high-speed turbine tooth extraction. Considering the accuracy and safe bone removal, the ultrasonic bone knife was better than the high speed turbine. It can not only reduce post-operative swelling, pain and soft tissue damage but also avoid the negative effects of high-speed turbines, such as osteonecrosis caused by heat generation. The use of sonic osteotome can reduce bone defect at the distal aspect of the second molar and increase the alveolar bone density.<sup>21</sup> Therefore, ultrasonic tome can better preserve the bone mass in the distal second molars. All these results show that, traditional tooth extraction surgery causes different degrees of periodontal damage, while the minimally invasive tooth extraction techniques can effectively promote alveolar bone healing.

For the lower third molars, conventional minimally invasive tooth extraction surgery may still result in bone loss and future periodontal pocket formation at the distal aspect of the second molar region.<sup>22</sup> After facing this issue, researchers had started to design a sonic osteotome window. By using ultrasonic osteotome to open a window on the mandibular buccal bone plate, the impacted 3<sup>rd</sup> molar can be removed, and the bone fragments will reset by its own.<sup>23</sup> In this special manner, the extraction socket forms a closed space that effectively isolates the growth of epithelial cells to benefit the hard tissue to regenerate and thus this technique shortens the duration of the healing-phase.

**Selecting the proper type of suture:** Widely used interrupted sutures are usually the surgeon's first choice. The anchor suture is another suture technique, which fixes the distal buccal-lingual gingival flap to the adjacent tooth in an anchor-like manner to avoid the V-shaped gap formation in the distal adjacent tooth. In a study, Cetinkaya *et al*<sup>24</sup> compared the effects of interrupted sutures and anchor sutures on the periodontal tissue of the adjacent second molar 6 months after impacted lower third molar extraction. They found that the PPD and CAL of distal second molars in the interrupted suturing group were significantly higher than those in the anchored suturing group, indicating that anchor sutures may be a better choice to maintain the periodontal health.

Zhu *et al*<sup>25</sup> conducted another research on the suturing practice and found that interrupted suture and "8" sutures were statistically significant in terms of PPD at 6 months after surgery. The "8" suture is more conducive to the healing of the

distal periodontal tissue of the adjacent teeth, which may make the mucosal epithelium closer to the distal root surface of the adjacent tooth to form a barrier to prevent lodgement of food debris, thereby protecting the periodontal tissue. The above studies show that anchor suture and "8" suture are more beneficial to periodontal tissue healing than interrupted suture.

**Interventions at the Post-Operative Stage:** Surgical extraction of impacted lower third molar is known to initiate periodontal destruction at the distal aspect of 2<sup>nd</sup> molar as well as aggravation of the already existing periodontal lesion. Starting from scaling, root planing to using GTR technique, using bone graft particles, surgical placement of collagen sponge and by other cell active ingredients transplantation, regeneration of the deteriorated periodontium can be achieved. All these procedures are utilized because these can induce cell proliferation as well as wound stabilization which will further help to regenerate the lost periodontium.

**Scaling & root planing:** SRP/ scaling and root planing is the first and foremost step of any periodontal therapy. Pons-Vicente *et al*<sup>26</sup> compared the effects of ultrasound and simple manual scaling and root planing on the distal second molar after impacted lower third molar extraction. The results had shown no significant difference between the two treatment methods on the distal periodontal tissue of the second molar. This is because, the SRP technique completely removes all the debris and microorganisms from the distal end of the 2<sup>nd</sup> molar tooth; so the root surfaces remain plaque free and no further periodontal degradation can be occurred. Xie *et al*<sup>27</sup> performed Impacted lower 3<sup>rd</sup> molar extraction combined with simultaneous periodontal treatments. After 6 months, they found that plaque index, gingival index, bleeding index, probing depth of periodontal pocket and bone loss in the experiment group was significantly lower than those in the control group, indicating that periodontal treatment can make the distal alveolar bone of the adjacent second molar more horizontal, which is beneficial to eliminate periodontal pockets and intrabony defects. Also, the elimination of periodontal pocket benefits plaque control, gingival health and accelerates the wound healing process.

**Guided tissue regeneration:** GTR or Guided tissue regeneration technique basically uses biocompatible barrier membranes (which may be absorbable or non-absorbable in nature), between the bone defect area and the surrounding tissues as a barrier, which will prevent gingival epithelium and connective tissue from infringing the root surface during the healing process and also allow the periodontal cells to migrate into the defect in a selective manner. In this way, a newly formed layer of cementum and pdl fibres are formed, which is known as the "new adhesive healing". Cortell-Ballester *et al*<sup>28</sup> in their study covered the third molar extraction sockets with an absorbable collagen membrane at one side and a blank control was kept on the other side. Six months after surgery, PPD and CAL of the distal second molars in the experimental group were significantly reduced compared with those in the control group, indicating that the absorbable collagen membrane can stimulate bone regeneration, with the improvement of the attachment level and bone filling, reduce the probing depth, and lead to faster healing of periodontal tissues.

**Using bone grafts:** Although autologous bone graft remains the "gold standard"<sup>29</sup> for bone regeneration, it can also

aggravate patient's injury and is limited by the patient's own bone mass. Therefore, it is recommended to use bone substitute materials or autogenous bone with bone substitute materials. The examples of bone substitutes are: allografts, xenografts and synthetic bone materials.

In the synthetic bone substitute materials, hydroxyapatite (HA) and bioactive glass are mainly used for bone defect repair. Singh *et al* suggested that HA with collagen membrane can increase bone regeneration in distal bone defects of second molars, but it is no longer used for repairing bone defects because of its degradability and poor plasticity. However, xenograft is widely used in clinical practice, among which the most commonly used is Geistlich Bio-Oss. Emerging investigations are demonstrating that single Bio-Oss materials can promote the repair of periodontal bone defects.

**Using cell-active ingredients transplantation:** Cell active ingredients which can be used to initiate regeneration inside the periodontium are: Platelet rich plasma (PRP), platelet rich fibrin (PRF), other platelet concentrates taken out from the bloodstream, concentrated growth factors (CGF) etc. By using all these cell-active transplant materials, stimulation of the cell proliferation can be initiated. Doiphode *et al* had assessed the efficacy of PRP and PRF on the bony defects, and revealed that PRF had improved periodontal health more efficiently when compared to other cell-active ingredients. In a study done by Gandevivala *et al*<sup>30</sup> PRP was used within the extraction sockets, and the experimental group was significantly different from the control group in terms of PPD. Similarly, Bhujbal *et al* had conducted the same study and found that the average bone density of the PRP group was significantly higher than that of the control group.

The periodontal management of the adjacent second molar after impacted lower third molar extraction, is quite challenging for the clinicians. Different interventions can restore the original periodontal structure and a functional attachment to promote periodontal tissue regeneration. These interventions have good clinical effects in the treatment of periodontal defects, and can be used as treatment to prevent periodontal complications after third molar extraction. The impacted lower third molar extraction is a very complicated surgical procedure, because:

- The space is really tiny, so manipulation of the extraction-instruments at that particular area becomes very problematic,
- There are a lot of important anatomical structures passing through this area which further makes it more difficult for the surgery.

Trismus, pain & swelling, injury to the inferior alveolar nerve and lingual nerve may occur in the immediate post-operative period because the soft and hard tissue of that area have to be manipulate for removing the impacted tooth. All these complications have highlighted the role of Oral Surgeon in prevention as well as management of aforementioned conditions. Sadly, these are not 'only' complications of impacted third molar surgery. Periodontal breakdown at the distal aspect of the 2<sup>nd</sup> molar is a known complication, but due to absence of any specific subjective symptoms; is often ignored by the clinicians. Consequently, plaque accumulation continues unhindered and the inflammatory destruction of periodontal tissues finally lead to a grave prognosis of the 2<sup>nd</sup> molar.

## CONCLUSIONS

For restricting the damage to the adjacent second molars and the periodontium around it, impacted lower third molar extraction should be performed after a thorough pre-operative clinical and Radiographical examination with synergistic efforts of periodontists and Oral Surgeons. The type of the suture, reasonable design of the flap, and following the techniques of minimally invasive extraction surgery will definitely lower the deterioration of the periodontium.

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