

# Orthodontic Management of Impacted Mandibular Second Molars: A Narrative Overview

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## Abstract

**Introduction:** Mandibular second molar impaction incidence has been clinically observed as increasing over the past period of two decades with different diagnosis and management approaches, stressing. High level literature evidence published regarding prevalence, etiology and treatment strategies for impacted mandibular second molars was assessed.

**Methodology:** Literature was searched through computerized databases, manual assessment and validated texts on the theme of impacted mandibular second molars for narrative overview.

**Results:** Through a narrative overview impacted mandibular second molars has been presented from prevalence, etiology, diagnosis and management perspective. Decision making, clinical relevance and treatment strategies have been outlined as a guidance for young clinicians to ensure maximum success.

**Conclusions:** Presented information in this narrative overview can facilitate / assist young clinicians in resolving impaction related concerns with possibly greater precision.

**Keywords:** Impacted, mandibular second molars, uprightening, eruptive disturbances

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## Introduction

Orthodontists find it challenging to diagnose and clinically manage the mandibular second molar (MM2) impactions that require selection of careful and detailed treatment plan to perform in the narrow posterior zone and to remove these impactions. The purpose of study is to review MM2 impactions, considering the prevalence, etiology, diagnosis, classification, and orthodontic care to offer a thorough manual for sorting out these effects in clinical practice.

## Methodology

This literature review was formulated using

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the information obtained from search engines using keywords with the intended results as shown in table-I

Search Engine	Resource from dates > year 2000
Pubmed	Meta Analysis
Embass	Systematic Reviews
Google Scholar	Cross Sectional Studies Case Series Case Reports

**Table-I: Search Repositories**

The targeted outcomes were etiology and surgical as well as orthodontic management of impacted mandibular second molars.

## Definition:

MM2 impaction is defined by Shapira et al. as:<sup>1</sup>

Criteria	Description
Asymmetric eruption	Full eruption of MM2 on one side, while contralateral MM2 hasn't erupted despite the three-fourths root formation
Mechanical locking	Mesial cusp of impacted MM2 is mesially angulated and locked in tight contact with the distal wall undercut of MM1

**Table-II: Definition MM2**

### Prevalence:

Reported prevalence of MM2 impactions ranges from 0.03-0.65%, though the incidence seems rising especially among males (11-14 Years).<sup>2-4</sup> The frequency of unilateral impactions is greater as compare to bilateral impactions.<sup>1</sup> In Chinese- American population, an autosomal dominant inheritance pattern has been found to be more prevalent.<sup>5</sup> Second molar impactions are less common in borderline crowding cases (5-9 mm) when extractions are combined with non-extraction therapy used in moderate crowding instances.<sup>6</sup> In rare instances, kissing molar including impacted mandibular 2nd or 3rd molars or 2nd and 1st molar have been documented. The teeth in question have roots pointing in the opposite direction and share the same follicular space.<sup>7</sup>

### Etiology:

The etiology of mandibular second molar impactions is complex. It has been discovered that incidence of MM2 impaction is greater in those with shorter mesial roots.<sup>1</sup> Mandibles lacking sagittal and transverse development displayed impacted second molars under craniofacial development.<sup>8,9</sup> Tilted MM2 is also associated with delayed eruption or impaction.<sup>10</sup> Literature suggests a correlation between impacted MM2 and the use of functional appliance, lip bumper and lingual arches (7%-11.9%).<sup>11-12</sup>

Odontogenic tumors, odontome and supernumerary tooth act as a physical

obstruction in eruption pathway leading to impactions.<sup>13</sup> Eruption may also be hampered by soft tissue pressure from lips. Tongue or fingers.<sup>13,14</sup> Chen et al.<sup>15</sup> concluded that removing physical barrier in eruptive pathway can facilitate MM2 eruption. MM2 impactions may also be influenced by primary failure of eruption (PFE).<sup>16-17</sup>

Eruption issues have been classified by Raghoobar<sup>18</sup> and Andreasen<sup>19</sup> as:

**Impaction:** tooth retention brought on by an irregular eruption path, a physical barrier, or a lack of space.<sup>13</sup>

**Primary retention:** undoubtedly because to aberrant osteoclastic activity, the eruption was impeded prior to gingival appearance without any physical barrier or ectopic eruption of the tooth germ.<sup>20</sup>

**Secondary retention:** Small patches of ankyloses are most likely the source of a tooth's stop of eruption without physical obstruction following gingival emergence, which is more prevalent than primary retention.<sup>21</sup>

### Diagnosis:

Impacted MM2 exist as an accidental finding in younger age groups and the diagnosis may be postponed due to lack of pain symptoms and a posterior dental arch involvement opposed to an anterior tooth which is radially apparent to both the patient and their parents.<sup>22</sup>

Diagnosis may be incidental, on routine clinical examination or on a periapical radiograph, panoramic radiograph and/or CBCT.<sup>21</sup>

### Treatment Strategy of MM2:

#### Decision Making:

The prime age for predictable treatment results is considered<sup>14</sup>, as adolescents presented better outcomes compared to adults.<sup>23</sup> Root development at this age is one of the possible explanation that could favor treatment outcome.<sup>21</sup> It is also important to analyze posterior available space (PAS) in treatment planning to prevent any future periodontal problems.<sup>24</sup>

The patient's age, the impacted tooth's angulation, developmental stage of root, caries, periodontium related issues, access in oral cavity and quality of alveolar bone surrounding the teeth are all important factors to consider while planning a course of treatment.<sup>25</sup> Deeply impacted MM2 with close proximity to inferior alveolar nerve are advocated for surgical extraction.<sup>26</sup>

### Treatment Alternatives:

**1.1. Orthodontic Uprighting and Surgical Exposure:** One safe, useful and efficient method for treating impactions is forced eruption with surgical help with or without orthodontic involvement.<sup>27,28</sup> As posterior dental crowding can impede the uprighening procedure it is best to remove MM3 at the same procedure.<sup>19</sup>

To apply vertical and distal force on MM2, a section of rectangular NiTi wire can be engaged vertically on the mesial aspect after the surgical exposure.<sup>29</sup>

As an alternate Brass wire usage by engaging it on the mesial aspect during the surgery has also been demonstrated effective.<sup>30</sup>

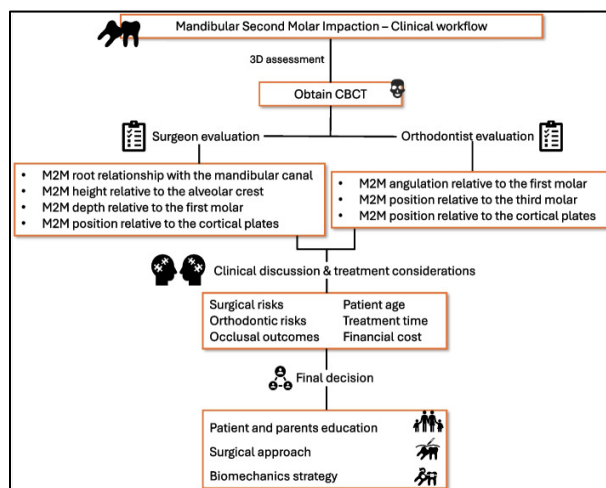
Later, an orthodontic attachment may be cemented. In a later section, certain relevant molar uprighening mechanics are covered.

**2. Surgical Uprighting of MM2:** Using mild luxation motion, the molar is tipped distally around its root apex. The procedure outlined by Pogrel et al<sup>31</sup> involves elevation of buccal flap and extracting the third molar. An elevator is placed on mesial aspect and gently tipped distally to luxate the MM2 after the bone from the distal side is guttered<sup>32</sup> This method significantly reduces the need for orthodontic intervention and works well when carried out by the skilled surgeon. Indications for surgical uprighening are as follows:<sup>4</sup> An adult patient with mesially impacted MM2 at an angle less than or equal to 75° MM2 with one-half to two-thirds root formation No intraoral clinical visibility of MM2 on examination Orthodontic treatment otherwise not required.

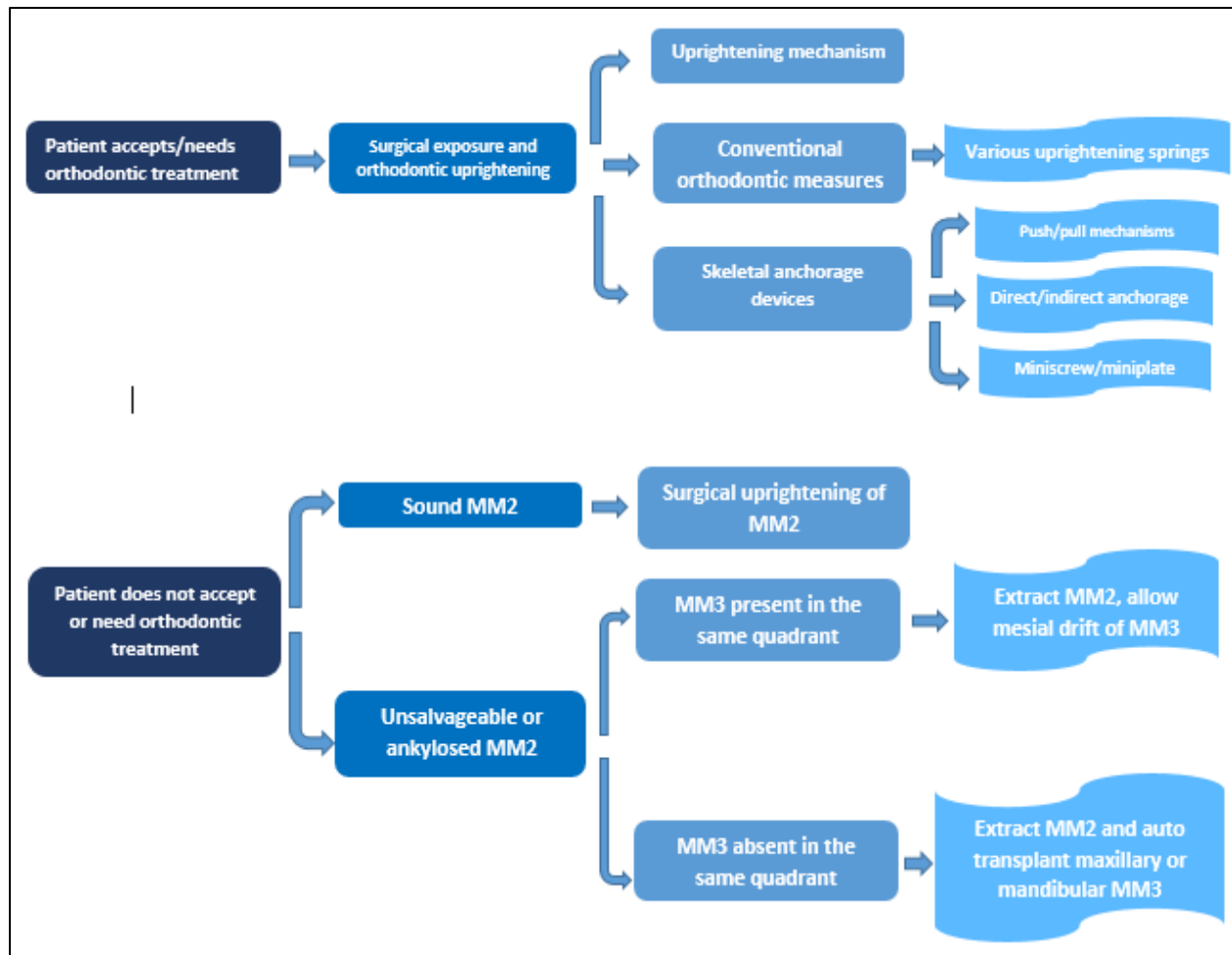
Root divergence of impacted MM2 is the most significant contraindication because any modification could result in loss of vitality.<sup>23</sup>

The technique reported the success rate of 90%<sup>33</sup> but it must be done very carefully as there is a chance of infection (1.9%), pulp obliteration (27.1%), external root resorption (14.9%), root fracture (1%) or ankyloses.<sup>34</sup> After positioning adjustment, the majority of teeth end up in a buccal cross bite raising doubts about stability of up-righened MM2 after surgery.<sup>4</sup>

**Extraction of MM2 With Mesial Drift of MM3:** This treatment option is taken into consideration when there is severe horizontal impaction of MM2, which makes its retrieval or uprighening impossible. The considerable treatment option in this case is the extraction of MM2 and MM3 is allowed to spontaneously drift anteriorly.



**Fig. I: Clinical workflow of the decision-making process for impacted mandibular second molars<sup>27</sup>**



**Fig. II: Management options for impacted mandibular second molars**

The elimination of orthodontic phase of treatment is one possible advantage, provided the root formation of MM3 is still ongoing.

Other indications<sup>9</sup> for this alternative option include: Ankylosed MM2 progressive demineralizing lesion in MM2 patient's refusal for treatment of orthodontic up rightening or auto transplantation.

One potential disadvantage is that it may not be possible to avoid orthodontic treatment completely in order to align MM3 and establish distal contact with MM1 due to supra -eruption of opposing MM2.<sup>9</sup> If further orthodontic treatment is not feasible this treatment option should be avoided because, Numerous studies have shown that only about 50–66% of the third molars in all attempted cases attained their intended

placements.<sup>35</sup> Few studies have also reported as 11%.<sup>36</sup>

#### **Auto Transplantation of MM3 Followed by Extraction of MM2:**

One of the non-orthodontic treatment options is auto transplantation of MM3 followed by extraction of MM2, which is indicated in following conditions MM2 Ankylosis, progressive MM2 Caries, patient not opting for orthodontic intervention and where MM3 has partially developed root.

Ankylosis of the implanted tooth is unavoidable with auto transplantation; success rates have been reported to be 68%.<sup>9</sup>

**Orthodontic Management:** Orthodontic treatment primarily consists of impacted MM2 up-rightening, arch alignment and coordination.<sup>34</sup>

There are several techniques to apply force for this tipping moment like wire bending, forming loops and exerting push force utilizing dental anchorage or various anchorage devices.

#### **Traditional Uprighting Methods:**

Numerous mechanical methods for orthodontic uprightening of impacted MM2 have been mentioned in numerous texts and case reports. Commonly used up-righting springs include; custom made cantilever springs, Ni-Ti Coil Spring, U-loop wire spring, continuous flexible rectangular NiTi wire, T-loop uprighting spring, helical loop uprighting spring, omega loop uprighting spring, open-coil spring-assisted uprighting, closed-coil spring-assisted uprighting, and segmental arch technique for molar uprighting are commonly employed methods.<sup>37</sup> According to a recent study by Chen et al.<sup>38</sup>, the PASS technique can be used to resolve MM2 impactions concurrently with maxillo-mandibular protrusion in a very straightforward and effective way because, if third molars have been extracted, the buccal tubes used in this technique can align the impacted MM2 by passing simple round NiTi wires. Another study resolved the issue by inserting Chen's up-rightening spring, which was made of 0.020-inch stainless steel wire, into the buccal tube on the exposed distal surface of the impacted MM2.<sup>39</sup> A pole approach can be employed in conjunction with segmental posterior lower arch therapy to successfully upright molars and naturally improve bone abnormalities distal to first molars, according to a retrospective study by Po-Sung fu et al.<sup>40</sup> It should be highlighted that case reports makeup the bulk of previously accessible data, so results must be taken very carefully and can't be generalized to apply on other scenarios.<sup>41</sup>

The dentition that is present anterior to the impaction provides anchorage for these movements; therefore, any negative consequences are unavoidable. These include the anchorage unit's undesired reciprocal

movement, MM2 extrusion and distalization, prolonged treatment times, and the requirement for large equipment in a small operating zone.<sup>42</sup> By lowering the anchorage load through inter-arch stabilisation, several of these drawbacks can be addressed.<sup>43</sup>

#### **Skeletal Anchorage Devices:**

The development of temporary anchorage devices such as mini screws and mini plates that use skeletal support has made it possible to reduce treatment duration, minimal negative effect on dentition and increase in treatment effectiveness.<sup>44</sup> Both traditional and skeletal anchoring uprightening techniques were found to be equally successful mechanically in prospective case-control research by Mezio et al.<sup>45</sup>, with the latter being linked to shorter treatment periods and a higher oral health-related quality of life (OHRQoL). The insertion and removal of TADs has become more convenient with the availability of clinical guidelines, resulting in predictable treatment outcomes.<sup>46</sup> When using these devices, crucial biomechanical choices about push/pull force direction and direct/indirect anchoring must be made during the treatment planning phase.<sup>47</sup>

One of the numerous therapeutic uses of free-hand TADs implantation reported in literature is assistance for orthodontic movement of impacted second molars.<sup>48</sup>

The extra-alveolar, edentulous alveolar ridge in the molar region or the spaces between the roots of neighbouring anterior teeth are suggested locations for miniscrew implantation. The retro molar area, distal to the impacted MM2 is the preferred site for placement of miniscrews. Progressive uprightening, better root parallelism, and a notable rise in alveolar bone height distal to the mandibular first molar were all demonstrated in a three-year prospective research assessing orthodontic uprightening utilising mini-screws placed in the retro molar area.<sup>49</sup> Elastomeric chains, buttons, and open or closed coil springs can all be used to apply force.<sup>50</sup> With anchorage derived from

direct source, elastic generated linearly directed pulling force from implant head is attached on the attachment on MM2. Due to the strong soft tissue in this area, restricted accessibility, and additional discomfort for the patient, this procedure is regarded as high in difficulty and necessitates the extraction of the corresponding third molar.<sup>34</sup>

Rigid stainless steel wires are employed in indirect anchorage scenarios to keep the anchorage teeth stationary while the small implant provides pushing, distalizing, and uprightening force.<sup>51</sup>

In comparison to indirect force application, direct methods are considerably simpler providing the use of mini screw and attachment independently, with maximum anchorage not involving the rest of the dentition, shorter activation time, enhancing patient comfort. However, when it comes to lingually tipped or rotated molars, direct approaches can't produce an effective system since a single linear force does not serve the purpose.<sup>52</sup>

Mini plates which can be surgically inserted into the retro molar trigone or ramus of the mandible, are the alternate of mini screws.<sup>53</sup> In order to apply traction to the impacted tooth one end of the plate that serve as an attachment site is left exposed in the oral cavity.<sup>54</sup> Although, Miniplates provide critical anchorage and desirable force biomechanics their use is restricted since they require surgery for placement and removal, are difficult to maintain oral hygiene, and carry a risk of infection in the first few days following insertion.<sup>55</sup>

## Conclusion

Impacted mandibular second molars present a problem for the orthodontist treating them. A proper treatment plan must be agreed upon and its implementation must be decided upon after a satisfactory clinical and radiological examination. To effectively resolve these impactions, this must be done with relation to

the related biomechanics and equipment. The patient's age, a clinical examination, or an incidental discovery on a routine panoramic radiograph might all be used to make a diagnosis. The patient's age, level of root growth, impacted tooth condition, and treatment willingness of the patient, all influence the choice of treatment approach.

This review article provides an overview of four therapy options for MM2 impaction resolution. Better treatment results are promised by orthodontic uprightening and surgical exposure. Distalizing and tipping back impacted teeth employing skeletal anchoring devices or traditional uprightening techniques are important biomechanics to consider. Direct or indirect anchorage is possible, and a range of attachment appliances are available to fulfil this function. By using this information in a clinical setting, orthodontists may be able to predictably treat MM2 impactions while also enhancing patients' quality of life, occlusal function, and oral hygiene maintenance.

## Ethical Approval

The study was approved by the Ethical Review Board of Islamabad Medical & Dental College, Islamabad.

## Disclaimer

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Conflict of Interest

It is declared that the authors don't have any conflict of interest.

## Authors' Contribution

**FS:** Conceptualization, study design, manuscript writing

**KB:** Methodology, statistical analysis

**HSQ:** Manuscript editing, proof reading

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