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**TITLE:**

To prophylactically extract or not to extract partially erupted mesio-angularly impacted lower third molars?

**SHORT TITLE:**

Prophylactic removal of partially erupted mesio-angularly impacted lower third molars.

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## **ABSTRACT** (204 words)

### **Introduction:**

Prophylactic removal of mesio-angularly impacted mandibular third molars (MAIM3Ms), has been discouraged by the National Institute for Health and Care Excellence in 2000. Consequently, partially erupted MAIM3Ms are retained for longer and only extracted if complications arise. The debate whether to extract prophylactically or to monitor these teeth is ongoing.

### **Pathologies associated with retained partially erupted MAIM3Ms:**

Retaining third molars long into adulthood has been associated with an increased risk of distal cervical caries and external root resorption of the second molar, periodontal disease and pericoronitis among other pathologies. Although watchful monitoring can aid to identify these pathologies, their nature often leads not only to a poor prognosis for the third molar, but also of the second molar, which then requires costly and time-consuming restorative or even prosthodontic work.

### **Considering prophylactic extractions:**

While an individual risk assessment is paramount, prophylactic removal of partially erupted MAIM3Ms has been shown to have positive effects on oral health-related quality of life, relieve the pressure on secondary care services and to be economically feasible for the NHS.

### **Conclusion:**

While long-term prospective cohort studies are necessary to put an end to the ongoing controversy, patients' needs and wishes should be at the forefront of the provision of care.

## **IN-BRIEF**

- Levels of third molar removal in England are exceeding levels prior to the introduction of guidance from the National Institute for Health and Care Excellence in 2000, with more patients attending secondary care for third molar procedures
- Partially erupted mesio-angularly impacted mandibular third molars are retained until they become symptomatic later in life which can lead to complications involving the adjacent second molar
- As long as high-quality evidence remains unavailable, mesio-angularly impacted mandibular third molars removal should be offered to patients on the NHS

## INTRODUCTION

Third molars (3Ms) are colloquially referred to as wisdom teeth due to their eruption into the oral cavity at a more mature age, between 17 and 21 years. As they are the last teeth to erupt, there is often a lack of alveolar arch space distal to the second molar (2M) tooth, leading to their impaction. Due to the reduced time for mandibular growth and its cessation at a similar time to mandibular third molar (M3M) eruption in females,<sup>1</sup> incidence rates of M3M impaction are higher in females compared to males. Although the prevalence of impacted third molars in the UK is unknown, its prevalence is reported to range from 18–68% internationally of which around 41% are classed as mesio-angularly impacted.<sup>2</sup> Historically, prophylactic M3M surgery was common practice, but with the introduction of the guidance from the National Institute for Health and Care Excellence (NICE) in 2000,<sup>3</sup> this practice was discouraged and many mesio-angularly impacted mandibular third molars (MAIM3Ms) are retained until they become symptomatic later in life. Still, there is ongoing controversy among dentists and oral surgeons regarding best practice despite the vast number of publications in this field.

The controversy concerning prophylactic removal of asymptomatic partially erupted MAIM3Ms is based on evaluating costs and risks of M3M surgery versus watchful monitoring. It is often argued in the literature<sup>4,5</sup> that the current guidance by NICE<sup>3</sup> and the Royal College of Surgeons<sup>6</sup> promotes reactive treatment rather than proactively minimizing the risk of pathology development. Justifications for prophylactic M3M removal include the reduction of risk of distal cervical caries (DCC)<sup>7</sup> and external root resorption (ERR)<sup>8</sup> of the 2M, periodontal disease and pericoronitis,<sup>9</sup> reduction of cyst and tumour development,<sup>10</sup> reduction of mandibular fracture risk<sup>11</sup> and the fact that the majority of M3M surgeries are merely delayed,<sup>12</sup> which in turn increases the difficulty of surgery with age.<sup>13</sup>

## **PATHOLOGIES ASSOCIATED WITH RETAINED PARTIALLY ERUPTED**

### **M AIM3Ms**

One of the most common pathologies associated with partially erupted M AIM3Ms is pericoronitis,<sup>4</sup> which is brought on by the accumulation of plaque and bacteria beneath the soft tissue operculum of the M3M, and sometimes also surrounding the adjacent 2M, resulting in inflammation and infection. In fact, 43% of partially erupted M AIM3Ms have been reported to show signs of pericoronitis,<sup>9</sup> In line with the NICE guidance,<sup>3</sup> patients are often prescribed several courses of antibiotics for recurring episodes of pericoronitis prior to M AIM3M removal, making pericoronitis the second most common indication for the prescription of antibiotics in dentistry, after acute dento-alveolar infections.<sup>14</sup> The recent white paper regarding the reduction of antibiotic resistance by Thompson et al.<sup>15</sup> has attributed the dental profession a ‘vital responsibility’ in combating antimicrobial resistance. Prophylactic removal of M AIM3Ms alongside antibiotic stewardship programmes could prevent the prescription of multiple courses of antibiotics for pericoronitis and hence significantly reduce the use of antibiotics in the dental setting. In addition, research has shown that patients with previous symptoms of pericoronitis benefit significantly from M3M removal in terms of improved oral health-related quality of life (OHRQoL)<sup>16</sup> and that discomfort from M3M surgery is no greater than the discomfort experienced from a single multiday episode of mild pericoronitis.<sup>17</sup> Furthermore, serious and potentially life-threatening complications in the form of deep space abscesses, more common in medically compromised patients<sup>18</sup>, could be avoided.

From 2000 until 2010, the incidence of ‘caries and related infections’ as the main clinical diagnosis for third molar removal in secondary care had escalated by over 200%.<sup>12</sup> Partially erupted M AIM3Ms have been shown to be significantly associated not only with caries of the impacted molar itself but also with DCC, forming on the distal cervical root surface of the 2M.

This is a result of ineffective cleaning and food trapping as well as the formation of a deficient gingival collar at the cementoenamel junction (CEJ) of the 2M as a consequence of the angulation of the impacted M3M.<sup>7</sup> Owing to the relatively slow development of caries compared to pericoronitis, DCC develops later in patients<sup>19</sup> and has led to the mean age of M3M removal to increase from 25 years in 2000 to 32 years in 2010.<sup>12</sup> Interestingly, patients presenting with DCC typically have superior oral hygiene compared to the general population reducing their risk of developing pericoronitis earlier in life and hence allowing time for DCC development.<sup>19</sup> The recall interval, as set out in the NICE guidance,<sup>20</sup> for this patient group is 24 months, which is rather counter-productive for patients at increased risk of DCC<sup>21</sup> and can lead to DCC lesions progressing deep into the tooth before being diagnosed, causing irreversible damage to the pulp which requires root canal therapy or rendering the 2M unrestorable. Clinically, it can be challenging to diagnose DCC as visualisation is often hindered by the partially erupted MAIM3M and while close radiographic monitoring may detect early lesions in the 2M, the damage to an otherwise healthy tooth cannot be undone and the tooth enters the “restorative cycle”.<sup>22</sup>

Similar to DCC, external root resorption also leads to dental hard tissue loss on the posterior surface of the 2M at the level of the CEJ. Unlike DCC though, ERR is caused by odontoclastic activity as a result of continuous pressure exerted by impacted M3Ms on the cementum or outer dentinal surface of 2Ms.<sup>8</sup> Mesial inclination of M3Ms increases the contact area between the teeth which is a major risk factor for the development of ERR. Consequently, MAIM3Ms are associated with a significantly higher frequency of ERR in 2Ms.<sup>8</sup> ERR follows a similar pattern to DCC in that it also affects older age groups,<sup>23</sup> but it often stays undetected for even longer periods due to the asymptomatic and aseptic pattern of destruction of ERR up to the point when it reaches the pulp.<sup>8</sup> Early diagnosis attempts of ERR often fail due to the overlap of structures

on two-dimensional radiographs masking the signs of discrete ERR lesions.<sup>23</sup> Cone beam computed tomography (CBCT) eliminates aforementioned overlaps and can help to overcome the issue of missed diagnoses; however its routine use is discouraged for the planning of M3M surgery,<sup>24</sup> even though effective doses of panoramic radiography are no longer significantly lower compared to CBCT.<sup>25</sup> Once more, delayed intervention can potentiate the development of severe 2M pathology, potentially leading not only to the extraction of both the M3M and 2M but also to costly and complex prosthodontic work or even implant surgery, which would then again benefit from three dimensional imaging in the form of CBCT.<sup>26</sup>

As stated previously, complications surrounding M3M removal increase with age and studies have shown OHRQoL indicators to be more frequent in older patients who require M3M surgery.<sup>27</sup> Older age groups are 30% more likely to develop periodontal disease distal to the 2M and are twice as likely to suffer from postoperative periodontal defects after 3M removal.<sup>28</sup> Moreover, the persistence of periodontal defects is also age related.<sup>29</sup> According to the literature, germectomy of the M3M on the other hand avoids 2M damage while showing no signs of alveolar osteitis or inferior alveolar nerve (IAN) involvement.<sup>27</sup> Overall, the postoperative morbidity after 3M removal is higher with increasing age<sup>13</sup> indicating that early removal of partially erupted MAIM3Ms would benefit the patients.

## **CONSIDERATION OF PROPHYLACTIC EXTRACTIONS**

The problems highlighted above are preventable and could be avoided by prophylactic extraction of partially erupted MAIM3Ms. Naturally, patients need to be informed about the risks of M3M surgery such as permanent dysaesthesia of the IAN and the lingual nerve, reported at 0.91% and 0.37% respectively.<sup>30</sup> In high-risk patients, where the roots of the M3M are closely associated with the inferior dental canal radiographically, the risk to the IAN can



be reduced by 84% when performing a coronectomy, provided that the tooth is vital, non-mobile and free from caries or root pathology.<sup>31</sup> Besides, patients should not be medically compromised and be fully aware of possible complications such as alveolar osteitis, infection and re-operation among others.<sup>31</sup> Equally, patients have the right to be informed about the consequences of non-intervention, as described above, and the benefits of prophylactic removal. The GDC standards 1.4 and 1.7 clearly state that the patient's interests should be put first and that a preventative approach tailored to the patient's needs should be taken.<sup>32</sup> Following appropriate clinical and radiographic examination, a thorough risk assessment, encompassing the potential risks and benefits of retaining or prophylactically removing any partially erupted M3Ms should be presented to the patient so that they can make an informed decision and be allowed to decide the fate of their tooth.

As it stands, prophylactic removal of M3Ms is not covered by the National Health Service (NHS) since the introduction of fiscal policies following the NICE guidance on third molar removal in 2000.<sup>12</sup> In contrast to this, European countries such as Germany<sup>33</sup> and France<sup>34</sup> do not limit M3M removal to teeth displaying pathological changes, but rather allow for clinical decision making on a case-by-case basis. German guidelines, for example, find that no clear distinction can be made between prophylactic and therapeutic M3M removal as pathology has been shown to develop and progress in the absence of clinical signs or symptoms.<sup>33</sup> In 2017, the American Association of Oral and Maxillofacial Surgeons published a clinical paper in which they describe the surgical removal to be the 'treatment of choice' for all impacted M3Ms and advocate treatment to be carried out as soon as possible.<sup>35</sup> From a clinician's point of view, it is important to remember that while NICE advises against the extraction of pathology-free impacted M3Ms in their guidance,<sup>3</sup> it is merely that, guidance; a tool to aid clinical decision-making.

Despite an initial decline, levels of M3M removal in most parts of the United Kingdom are exceeding levels prior to 2000, with more patients attending secondary care for M3M procedures,<sup>36</sup> likely as a consequence of the reduced number of M3M removals performed by general dental practitioners. This in turn has drastic financial implications and treatment of DCC of the 2M alone has been estimated to cost approximately £27million per annum.<sup>36</sup> To date, the literature offers very limited economic evidence with regards to the comparison of prophylactic removal of impacted M3Ms versus watchful waiting. While earlier cost-effectiveness analyses<sup>37,38</sup> found no economic evidence to support prophylactic removal of impacted M3Ms, an independent economic assessment based on long-term cost-utility analyses carried out by the Liverpool reviews and implementation group<sup>39</sup> determined an incremental cost-effectiveness ratio per quality-adjusted life year (QALY) gain of £11,741 for prophylactic removal of impacted M3Ms versus watchful waiting. Not only is this distinctly less than the £20,000 per QALY gained threshold set by NICE<sup>40</sup>, but costs would be further reduced if the proportion of surgical removals were carried out in a primary care setting as a Band 2 treatment.<sup>39</sup>

In 2015, NICE reviewed the evidence regarding indications for the prophylactic removal of M3Ms and are currently in the process of updating these. As conducting long-term randomised controlled trials comparing the two schools of thought, to retain or to prophylactically extract partially erupted MAIM3Ms, are unlikely to be undertaken in the near future, high-quality and long-term prospective cohort studies are required to provide the necessary evidence. Until such evidence becomes available, a 2016 Cochrane review<sup>41</sup> concludes that in cases of asymptomatic disease-free impacted M3Ms, the decision-making process needs to be based both on operator expertise and the patient's values.

## **CONCLUSION**

In summary, while NICE guidance aimed to decrease the overall number of 3M removals, there is mounting evidence that MAIM3M surgery is merely being delayed, bringing with it a variety of problems for the patients. These range from increased prevalence of caries and periodontal disease of the 2M and M3M as well as increased difficulty of surgery, to decreased OHRQoL and potentially life-threatening deep space abscess formation following M3M infection. In light of this and the limited amount of high-quality evidence available, it is this author's opinion that patients should have more autonomy and be offered prophylactic MAIM3M removal on the NHS, following consolidation of the associated risks and benefits of the treatment, thorough clinical and radiographic examination, and on a case-by-case basis taking into account relevant medical history.

## DECLARATION OF INTERESTS

The author has no conflicts of interest to declare.

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