

# Prophylactic removal of unerupted asymptomatic third molars: is it justifiable?

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•Conflicts of interest: none declared.

## ABSTRACT

**Objective:** to review the literature currently available on the evidence that does or does not justify the prophylactic extraction of unerupted asymptomatic third molars.

**Material and Methods:** the electronic databases PubMed, Capes Periodicals, Web of Science and Scopus were searched from November to December 2016 by two authors, simultaneously, using as search terms: Terceiro Molar/Molar, Third AND Extração Profilática/Prophylactic Removal OR Prophylactic Extraction. We included articles from original research and clinical trials published in English and Portuguese. No limits were applied to the date of publication. Review articles and clinical case reports were removed.

**Results:** we identified 13 studies that addressed, at some aspect, the prophylactic removal of unerupted asymptomatic third molars. The results of this literature review which alluded to the potential for the formation of pathological alterations in asymptomatic third molars are conflicting; While some justifies the prophylactic procedure based on the possible formation of associated lesions, other scientific evidence does not support such practice. **Conclusion:** in view of the conflicting viewpoints found in the literature, the prophylactic removal of asymptomatic third molars requires case-by-case evaluation of each patient, and the decision-making process, regarding the retention versus the prophylactic removal of these teeth should be based on scientific evidence combined with the clinical experience of the professional.

**Keywords:** Oral surgery; Third molar; Unerupted tooth; Disease prevention.

## Introduction

The extraction of third molars is one of the most common procedures in the clinical practice of dentists worldwide. It is estimated that, in the United States, approximately 10 million impacted teeth are extracted annually from approximately 5 million individuals, generating a revenue of 3 billion dollars.<sup>1,2</sup> In England and Wales, extractions of third molars between 1995 and 1996 totaled approximately 5.2 million pounds.<sup>3</sup>

Prophylactic extraction, the most common reason for extraction of third molars,<sup>4</sup> is widely recognized by a considerable number of dental surgeons.<sup>2,5</sup> This fact is based on the association of these teeth with oral pathological changes such as pericoronitis, periodontal problems, caries in third or second molars, different types of odontogenic cysts and tumors as well as crowding of the lower incisors.<sup>6-14</sup>

The scientific literature also mentions other reasons to justify this procedure, considering the fact that these teeth do not always play a functional role in the oral cavity as well as an increased risk for postoperative complications, pain and discomfort when their surgical removal is performed in more advanced aged patients.<sup>15-21</sup> However, other studies suggest that the lower third molars should not be removed prophylactically in some cases<sup>2,14,22-23</sup> and vigilant monitoring of these teeth is more appropriate strategy.<sup>24</sup>

Debate about indications for prophylactic removal of im-

acted third molars remains heated.<sup>11</sup> The decision-making process regarding retention versus prophylactic removal of these teeth should be based on the available scientific evidence.<sup>25</sup> However, the literature is lacking in studies to support adequate clinical decision-making regarding prophylactic extraction of third molars.<sup>14</sup> This study aimed to review the literature currently available on scientific evidence that does or does not justify the prophylactic extraction of unerupted asymptomatic third molars.

## Material and Methods

For the purpose of this study, we followed guidelines provided by Moher *et al.*<sup>26</sup> in *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement*.

## Identification and Selection of Relevant Research

An exploratory bibliographic search was conducted from January to February of 2017 using the electronic databases: Public Medline (PubMed), Periódicos da Capes, Web of Science and Scopus. Two authors performed the search employing the term Third Molar in combination with Prophylactic removal OR Prophylactic Extraction (Table 1). Inclusion criteria were: original research articles and clinical trials published in Portuguese and English. No limits were applied to the year of publication.

Table 1. Search strategy for all databases

Search Terms Combination	Database
1. "molar, third"[MeSH Terms] OR ("molar"[All Fields] AND "third"[All Fields]) OR "third molar"[All Fields] OR ("third"[All Fields] AND "molar"[All Fields]) AND (prophylactic[All Fields] AND extraction[All Fields])	PubMed
2. Third Molar OR "molar" AND "third" OR "third molar" AND "prophylactic extraction" OR "prophylactic" AND "extraction".	Periódicos Capes
3. Third Molar OR "molar" AND "third" OR "third molar" AND "prophylactic extraction" OR "prophylactic" AND "extraction".	Web of Science
4. TITLE-ABS-KEY. Third Molar OR "molar" AND "third" OR "third molar" AND "prophylactic extraction" OR "prophylactic" AND "extraction".	Scopus

Studies were identified and duplicates were removed. Subsequently, titles and abstracts were screened for relevance, considering the exclusion criteria. Next, the remaining studies were obtained in full-text and were screened using the self-same criteria, the eligible the ones being included in this review. We removed review studies, clinical case reports, articles not available in full-text, and publications that did not address the prophylactic remo-

val of unerupted asymptomatic third molars. Eligible studies also had their reference lists screened following the specified criteria for the eligible ones.

### Data Collection and Analyses

All the selected articles addressed the relationship between third molars and pathological changes and included the following parameters: authorship, year of publication, country of publication, type of study, sample size (and age), outcomes measured, relevant data and results, and study considerations.

Based on the findings of the studies, we determined the following themes for critical analysis of the results: characteristics of the studies, prophylactic removal of third molars and implications for practice. Yet, considering our study design and its findings, we presented the section "study limitations".

### Results

For this systematic review, the initial electronic search yielded a total of 540 titles found in the databases: PubMed, Periódicos da Capes, Web of Science and Scopus. 433 studies were excluded for duplication and the remaining 107 unique papers were screened for relevance to this study. 55 publications were excluded after reading their titles and abstracts. Then, the 52 remaining documents were obtained in full-text and assessed for eligibility in consideration of the prophylactic removal of unerupted asymptomatic third molars. After reading the documents in full text, 13 studies were included (Figure 1 and Table 2). No studies from reference lists were added due to their either not being eligible or not having come up on the database search.

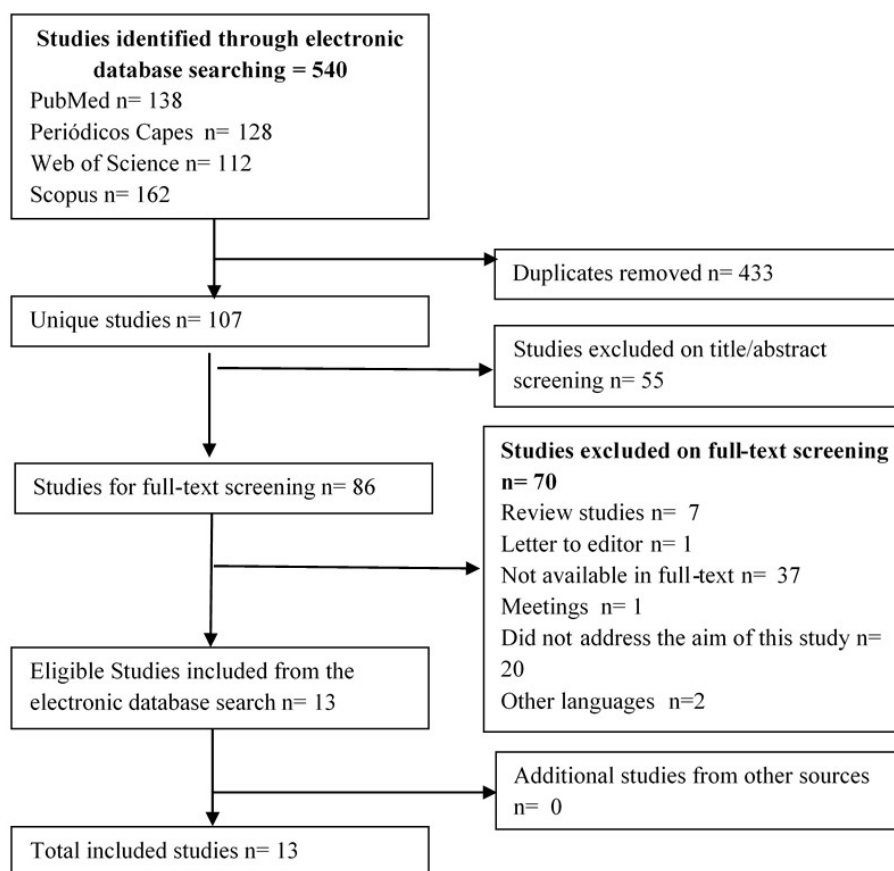


Figure 1. Flow diagram for the review of papers. Adapted from Moher *et al.* 2009

**Table 2.** Results of literature review displayed in chronological order

Author/Year (Country)	Study Type	Sample (Age)	Variables/ Relevant Data	Results	Conclusion/ Final Considerations
Kruger <i>et al.</i> , 2001 <sup>27</sup> (NEW Zealand)	Prospective	821 participants (18-26 years)	Participants were examined dentally at ages 18 and 26 years. Panoramic radiographs were taken at age 18, but not at age 26. For each tooth, the impaction at 18 years was compared with clinical status at 26 years of age.	Out of the 2857 third molars evaluated at 18 years of age, 92.8% were clinically evaluated at age 26. Approximately 54.9% of teeth that were not affected by age 18 had erupted at age 26. Of the teeth that were impacted at 18, 33.7% had fully erupted at 26, 31.4% were extracted, and 13.1% were not.	In addition to horizontally ITM, a substantial proportion of other types of impaction completely erupt, and apparent radiographic impaction in the late adolescence should not be sufficient reason for its prophylactic removal in the absence of other clinical indications.
Werkmeister <i>et al.</i> , 2005 <sup>11</sup> (Germany)	Retrospective	316 patients (300 with PRTM)	Panoramic radiological analysis was performed to determine whether changes or major pathological changes are related to the position of ITMs. The third molar positions were studied in 300 consecutive patients with ITMs prophylactically removed without any pathology (period of 5 years).	"position scores" correlated significantly with cysts formation. The lowest scores were found in angle fractures, abscess formation and in the control group as a whole.	PRTM is appropriate to prevent the formation of cysts or mandibular angle fractures in a population at risk of facial trauma. In addition to other factors, "tooth position score" data could be useful for the development of a model to predict serious complications related to (removal) of ITMs.
Hill; Walker, 2006 <sup>28</sup> (United Kingdom)	Prospective	Out of 250 patients, only 228 completed the evaluation period of 5 years. (16-30 years)	Examination of several factors, including smoking, tooth eruption, depth of the periodontal pocket and history of pericoronitis.	About one-third of the teeth had to be removed within 5 years. Although this does not allow for a "life extrapolation", this questions the current thinking boundary on asymptomatic ITMs and certainly suggests that more (possibly long-term) studies need to be completed.	There seems to be little cost-benefit when it comes to the prophylactic removal of asymptomatic third molars, but it was not possible to project this with absolute certainty.
Cabbar <i>et al.</i> , 2008 <sup>12</sup> (USA)	Histologic and immunohistochemical	59 Dental Follicles of 54 patients	The epithelial and mesenchymal components of the follicles were examined histologically for the evaluation of mucosal cell dysplasia. Proliferation of epithelial cells was determined using immunohistochemical labeling.	Expression of both proliferation markers in basal epithelial cells, mucosal and squamous epithelium and inflammatory cells were statistically significant (p <0.01)	Based on the findings, the authors support the prophylactic removal of asymptomatic impacted third molars.
Yildirim <i>et al.</i> , 2008 <sup>13</sup> (Turkey)	Histopathological	120 Dental Follicles of 115 patients.	The association between dental follicles and pathological changes, age, sex and angular position were statistically evaluated.	Among these follicles, 23% had pathological conditions. The relationship between pathological changes and angular position was not statistically significant.	The data do not justify the removal of all ITMs, but suggest that there is a risk of pathological changes, particularly as patients age.
Ozeç <i>et al.</i> , 2009 <sup>29</sup> (Turkey)	Retrospective	Records of 485 patients with 585 ITMs.	Patient's age, distal second molar caries, third molar angulation and second and third molar contact points.	The prevalence of distal caries of the second molar in the population was 20%. This prevalence was 47% when the third molar presented angulation of 31-708 (mostly mesioangulated third molars) and 43% in 70-908 (all third molars horizontal). The point of contact at the cemento-enamel junction of the second molar and the increase in age had significant effects on the formation of caries.	The results revealed that the distal caries of the second molar justify the prophylactic removal of the third molar and the partially erupted third molars that have an angulation of 30-908 with a point of contact at the cemento-enamel junction should be removed to prevent distal caries of the second molar.
Stathopoulos <i>et al.</i> , 2011 <sup>30</sup> (Greek)	Retrospective	7.782 ITMs removed of 6.182 patients	Frequency and type of cysts and tumors related to ITMs in Greek patients over a 12-year period. Indications, complications, risks, and benefits of ITM removals are also discussed.	Of the 417 specimens submitted to histopathological examination, 167 cysts (40.04%) and 48 tumors (11.5%) were found.	Surgical removal of ITMs should only be performed in the presence of specific indications. Our study confirmed that the incidence of pathological conditions related to ITMs is relatively low (2.77%).
Wali, Sridhar, Shyla, 2011 <sup>31</sup> (India)	Retrospective	Records of 416 patients	Association of ITMs retained with risk of adjacent second molar pathology (caries and / or periodontitis), based on the state of the third molar (absent, erupted or not erupted).	The lower prevalence and incidence of second molar pathology occurred when the adjacent third molar was absent.	Third molar retention is associated with increased risk of second molar pathology in middle-aged and elderly.
McArdle; McDonald; Jones., 2013 <sup>33</sup> (United Kingdom)	Prospective	288 CBCT of 239 patients (20-65 years)	The variables that were evaluated were sex, age, angulation and eruption state of the third molar, DMFT and proximity of the third molar to the amelocemental junction of the second molar	Radiographic examination showed that all teeth were in contact with, or near, the amelocemental junction of the second molar, and all were impacted mesioangulantly against the second molar. Distal cervical caries in the second molars is a late complication of third molar retention	Not all third molars should be removed prophylactically, but early prophylactic removal of a partially erupted third mesioangulated mandibular third molar will prevent the formation of distal caries in the adjacent tooth.
Tambuwala <i>et al.</i> , 2015 <sup>34</sup> (USA)	Histopathological Evaluation	52 Patients (18 – 52 years)	Early pathological changes in the follicular tissue of the impacted mandibular third molar.	80.8% of the specimens had normal follicles. 11.5% suggested cystic changes, while 7.7% suggested infected follicles	It is desirable to consider the prophylactic removal of impacted mandibular third molars presenting at a younger age, while their removal remains an enigma for the more advanced age group and should only be considered adequate in cases where frank causes are established for their removal.
Yadan <i>et al.</i> , 2016 <sup>35</sup> (India)	Cross-sectional	1187 patients (18-55 years)	The effect of the third molar inclined on the second molar was measured in relation to three parameters, viz., Level and position of the third molar relative to the second molar and the distribution between the arches.	Of the total teeth examined, only 5.4% of the upper jaws and 9.6% of the lower second molars were affected by inclined third molars. Only 2.2% of the mandibular and 2.9% of the maxillary second molars were indicated for extraction. The data were statistically insignificant.	It was concluded that the distal caries in the second molars is not very common. It may be present in some cases of impactions of the third molar. The prophylactic removal of these impacted teeth may not be considered appropriate.
Shin; Choi; Moon., 2016 <sup>36</sup> (Korea)	Retrospective	20,802 ITMs of 17,535 patients (13-78 years)	The prevalence of ITMs and associated cysts or tumors was analyzed in groups of patients stratified by age and sex. Patients in the pathology group were also classified according to histopathological findings and the corresponding age groups.	Radiographic signs of disease were detected in 176 lesions (0.846%) in 165 patients. Of these, 135 (76.4%) lesions were diagnosed as dentigerous cysts, 31 (17.6%) as keratocysticodontogenic tumors and 10 (5.7%) as ameloblastomas. The prevalence of cysts or tumors tended to increase after 50 years.	ITMs in patients older than 50 years have high chances of developing cyst or tumors. However, these results should not be used as the only evidence to warrant

TMI= Impacted Third Molars. PRTM = Prophylactic Removal of Third Molars; CBCT = Cone Beam Computer Tomography.

## Characteristics of the Studies

We identified 13 studies that addressed, in some respect, the prophylactic removal of asymptomatic third molars. The 13 documents fell into several different categories: retrospective (n = 5), prospective (n = 4), histopathological (n = 2), cross-sectional (n = 1), and histologic and immunohistochemical (n = 2).

According to our findings, we identified only six studies published at sporadic intervals within a ten-year time frame: 2001 (n = 1), 2005 (n = 1), 2006 (n = 1), 2008 (n = 2), e 2009 (n = 1). In the last six years, seven studies were published: 2011 (n = 2), 2013 (n = 2), 2015 (n = 1) and 2016 (n = 2) The results indicated the need for future research on the prophylactic extraction of unerupted asymptomatic third molars.

## Prophylactic Removal of Unerupted Asymptomatic Third Molars

Table 2 presents the main findings of all the 13 selected articles that addressed the prophylactic removal of unerupted asymptomatic third molars and included the following parameters: authorship, year of publication, country of publication, type of study, sample size (and age), outcomes measured, relevant data and results, and study considerations.

## Implications for Practice

In recent years, the shift in emphasis to nonintervention in patients with asymptomatic impacted third molars has been accompanied by a considerable debate.<sup>37</sup> The supporters of prophylactic removal argue that the benefits outweigh the risks. Nonetheless, the scientific evidence is too inconclusive to support prophylactic removal. Unfortunately, most of the clinical research has failed, leading to contradictory interpretations that have not completely clarified the relative risks and benefits of early intervention.<sup>38</sup>

Conflicting reports persists surrounding to the incidence of pathological conditions associated with impacted third molars, and the subsequent need for prophylactic removal. The data remain limited regarding the long-term effects of unerupted third molars on adjacent teeth.<sup>32</sup> According to Hicks,<sup>38</sup> unreliable data would serve only to fuel this debate and the controversy over proper protocols.

It is likely that disagreements persists on which clinical recommendations should be followed when considering the prophylactic removal of asymptomatic third molars.<sup>39</sup> Therefore, the decision to perform prophylactic removal of these teeth should be based on the probability of retained third molars causing future problems.<sup>30</sup>

Thus, the prophylactic removal of asymptomatic third molars requires individual care and case-by-case evaluation of each patient and the decision-making process regarding the retention versus prophylactic removal of these teeth should be based on the available scientific evidence combined with the professional's clinical experience.

## Study Limitations

This literature review has some limitations given that the literature is lacking in randomized clinical trials regarding of the prophylactic removal of unerupted asymptomatic third molars.

Other limitation found by the authors was the lacking in some full texts publications. However, available scientific evidence were included in order to better work on the subject. Sample sizes found in most studies were acceptable.

## Discussion

Prophylactic removal of unerupted asymptomatic third molars is defined as a surgical procedure in which the patient does not present or has not presented any symptoms or pathologies associated with unerupted third molars.<sup>29</sup> Currently, there is no general agreement as far as the necessity of surgical removal of asymptomatic third molars is concerned.

In order to minimize the risk of disease associated with these teeth<sup>30</sup> or to avoid complications at more advanced ages, due to the risk of trauma or mandibular fractures,<sup>11,40</sup> development of cysts and tumors,<sup>36</sup> patient's recovery and prognosis,<sup>41</sup> some authors believe that all unerupted third molars should be removed. Nevertheless, in this sense, there is still a need to compare the morbidity rates of tooth removal in people of several age groups.<sup>37</sup>

Occasionally, orthodontists propose the removal of asymptomatic third molars to complete orthodontic therapy.<sup>30</sup> Despite the fact that the role of third molars has been the subject of research, clinical interest, and debate for years, there is still a lack of scientific evidence from high-quality clinical studies on this subject.<sup>42</sup> However, Normando *et al.*<sup>43</sup> suggest that, in general, the best clinical conduct is not to proceed with the prophylactic extraction of third molars, except in situations where removal of a third molar is mandatory from the beginning of treatment.

The studies addressed in this literature review alluded to the potential for development of pathological alterations in unerupted asymptomatic third molars.<sup>11-13,27-36</sup> Some evidence shows a greater risk in the occurrence of mandibular fractures<sup>11</sup> or associated lesions such as cysts,<sup>11,12</sup> especially dentigerous ones,<sup>31,36</sup> suggesting the prophylactic extraction of unerupted third asymptomatic molars might be a treatment option worth considering.

Other studies do not support such clinical conduct,<sup>17</sup> considering that, even with the risk of occurrence of lesions<sup>13</sup>, which was relatively low,<sup>30</sup> the relationship between pathological changes and dental position was not statistically significant, and that it was not possible to come up with a significant cost-benefit relationship.<sup>28</sup>

According to some authors,<sup>28,32</sup> caries in the distal region of the second molar seem to be a factor that justifies the extraction of asymptomatic third molars, especially if the tooth is mesioangulated.<sup>32</sup> However, given that distal caries in the second molars is not very common in cases of third molar impactions, the prophylactic removal of these impacted teeth may not be considered appropriate.<sup>35</sup>

In this sense, in the absence of any other indication, the presence of radiologically diagnosable retention is not sufficient indication for the prophylactic removal of an asymptomatic third molar.<sup>27</sup> This is specially true given the lack of evidence from randomized clinical trials that this procedure would avoid painful or infectious pathological complications due to its retention.<sup>25</sup>

## Conclusion

There is some disagreement regarding the prophylactic extraction of unerupted asymptomatic third molars. Some authors

justify the prophylactic removal based on the potential of development of pathological changes while other available scientific evidence does not support such conduct.

The routine removal of unerupted asymptomatic or disease-free third molars will require individual care and assessment. A case-by-case management protocol is needed. The close monitoring of these teeth may be an acceptable option.

The decision-making process regarding the retention versus

prophylactic removal of unerupted asymptomatic third molars should be based on the available scientific evidences combined with the professional's clinical experience.

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### Mini Curriculum and Author's Contribution

1. Marlus da Silva Pedrosa - dental student. Contribution: scientific and intellectual participation for the study; study design; critical review; data acquisition; data interpretation; technical procedures; manuscript writing; final review.
2. Evelyn Bianca Soares Silva - dental student. Contribution: scientific and intellectual participation for the study; data acquisition; data interpretation; manuscript writing; final review.
3. Thais Oliveira Cordeiro - dental student. Contribution: data acquisition; data interpretation; manuscript writing; final review.
4. Luiz Gustavo Fernandes Lima Oliveira - DDS. Contribution: scientific and intellectual participation for the study; data acquisition; data interpretation; manuscript writing; final review.
5. Rodrigo Richard da Silveira - DDS, Msc and PhD. Contribution: scientific and intellectual participation for the study; data interpretation; technical procedures; final review.
6. Cláudio Heliomar Vicente da Silva - DDS, Msc and PhD. Contribution: scientific and intellectual participation for the study; study design; critical review; data interpretation; technical procedures; final review.
7. José Guilherme Férrer Pompeu - DDS, Msc and PhD. Contribution: scientific and intellectual participation for the study; study design; critical review; data acquisition; data interpretation; technical procedures; manuscript writing; final review.

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