



WHITE PAPER ON THIRD MOLAR DATA

A [Task Force](#) was convened by the American Association of Oral and Maxillofacial Surgeons in March 2007 to review the current literature with regard to selected aspects relating to third molars and their removal. Databases reviewed included Ovid Medline, PubMed, Google Scholar, and the Cochrane Database. Case reports were excluded. ([Bibliography](#))

The topics addressed are:

- Natural History of Third Molars
[Conclusions](#)
- Periodontal Considerations in Third Molar Removal
[Conclusions—presence of impacted third molars](#)
[Conclusions—third molar removal](#)
[Conclusions—reduction in post-operative loss of periodontal attachment](#)
[Conclusions—periodontal disease severity/progression](#)
- Microflora Around the Second and Third Molars
[Conclusions](#)
- Effects of Age on Various Parameters Relating to Third Molars
[Conclusions](#)
- Orthodontic and Prosthodontic Considerations in Removal of Third Molars
[Conclusions—third molars and dental crowding](#)
[Conclusions—third molars under removable prostheses](#)
- Current Imaging Techniques
[Conclusions](#)
- Possible Role of Coronectomy in Third Molar Removal
[Conclusions](#)
- Role of Lingual Flap Elevation and Lingual Retraction in the Management of Third Molars
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- Should Anything Be Placed in the Socket Following Third Molar Removal?
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- Nerve Damage—Prevention, Evaluation, and Management in Relation to Third Molars
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1. The Natural History of Third Molars

Clinical Question: Can the course of an unerupted third molar be predicted?

Background: The ability to accurately predict third molar eruption would allow clinicians to improve third molar treatment strategies. Several factors have been proposed to play a role in determining the likelihood of eruption, including tooth angulation, degree of root development, depth relative to the occlusal plane, size of the tooth, and the available space

for eruption (generally described as the mandibular ramus [Xi point] and the distal of the second molar). A shortcoming of most available studies is the absence of a periodontal examination of patients with erupted third molars.

The following points are supported by the literature:

- The most significant variable associated with third molar impaction is inadequate hard tissue space, with the vast majority of impacted third molars having space/crown width ratios of less than 1. (Ganss 1993, Forsberg 1989, Hattab 1999)
- It is possible to measure space for eruption to the occlusal plane using a variety of radiographic techniques. (Ganss 1993, Venta 1997)
- Unerupted teeth can change position even beyond the middle of the third decade of life. (Venta 2004)
- Because there is no completely reliable way to predict pathologic changes associated with impacted teeth, the life cycle of impacted teeth should be monitored periodically with radiographs. (Kahl 1994)
- Eruption to the occlusal plane does not ensure proper periodontal support, that is, adequate osseous space does not guarantee adequate physiologic space for the maintenance of a tooth in good health. (Nance 2006, Gungormus 2002)

Conclusions

While it is not possible to predict eruption of third molars in all cases, adequate space between the anterior border of the mandible and the distal of the mandibular second molar seems to be necessary to allow successful eruption to the occlusal plane. Assessment of this space can be determined using a variety of radiographic techniques. However, eruption to the occlusal plane does not imply a good state of health, particularly with respect to soft tissue support. Finally, third molars that remain impacted after the age of 25 may still change in position.

2. Periodontal Considerations in Third Molar Removal

Presence of a Third Molar: The potential for pathologic sequelae associated with impacted third molars has long been a concern and was the focus of a 1988 NIH conference, “Removal of Third Molars.” A retrospective study of panoramic radiographs revealed a relatively low incidence of periodontal ligament damage and bone loss (4.5%) and resorption of the distal surface of the second molar (3.1%). (Stanley 1988) Assessment of root resorption on the distal surface of the second molar adjacent to non-erupted third molars using periapical radiographs indicated a much higher frequency of root resorption (24.2%) that was positively correlated with age. An even higher prevalence (42%) of disruption of the periodontal ligament without root resorption was noted by Nemcovsky. (1996) Resorption of the distal of the second molar is associated with both mesioangular and horizontal impactions. (Knutsson 1996) A greater probability of probing pocket depth ≥ 5 mm on the distal of the second molar when a visible third molar is present has been found in large scale national studies, e.g., National Health and Nutrition Examination Survey (NHANES) III and the Artherosclerosis Risk in Communities study (Elter 2004, Elter 2005). In similar clinical circumstances, pocket depth ≥ 5 mm has been shown to be associated with loss of attachment ≥ 1 mm. (Blakey 2002)

Conclusion

The presence of impacted third molars adversely affects the periodontium of adjacent second molars as reflected in disruption of the periodontal ligament, root resorption, and pocket depth associated with loss of attachment.

Third Molar Removal: Virtually all of the literature regarding the impact of third molar removal on the periodontium of adjacent teeth has focused on the mandibular third molar. The effect of third molar removal as assessed by attachment levels, pocket depth and/or alveolar bone height on the distal surface of the adjacent second molar has been reported as being detrimental. (Kuang-Yao 2001, Kugelberg 1991, Quee 1985, and Kan 2002) The existence of an intrabony defect on the distal of the second molar, age at the time of surgery (older adults more likely to have adverse outcomes), the size of the third molar/second molar contact area, and inadequate post-extraction plaque control have been identified as being associated with loss of periodontal attachment following third molar removal. Conversely, others have reported no deleterious effects. (Krausz 2005, Richardson 2005) A Medline literature search identified 2 cohort studies and 6 randomized clinical trials with a minimum of six month follow-up that satisfied the inclusion criteria for pre and post operative measurements of attachment level or pocket depth on the distal of the second molar. (Richardson 2005) Collectively, these studies did not demonstrate negative changes in attachment level or pocket depth beyond the >2 mm adopted as the threshold for clinical significance. However, patients with a healthy pre-operative periodontium were at increased risk for loss of attachment or increased pocket depth after third molar surgery. One year postoperative comparisons of age groups ≤ 20 years v. ≥ 30 years demonstrated the advantage of early removal, and longer term (2 and 4 yrs.) comparisons of improvement in intrabony defects following third molar removal assessed radiographically were seen primarily in younger (≤ 25 years) patients. (Kugleberg 1991, Kugleberg 1990)

Conclusion

The removal of impacted third molars can negatively impact the periodontium of adjacent second molars. The preoperative existence of an intrabony defect, age of the patient, and level of plaque control may serve to predict adverse outcomes.

Reduction in Post-Operative Loss of Periodontal Attachment: Flap design does not appear to negate periodontal attachment loss on the adjacent second molar. (Quee 1985, Rosa 2002) Employment of a buccal window and a specific approach to tooth division have been advocated as ways to prevent periodontal defects, but these approaches have not been subjected to randomized controlled clinical trials. (Motamedi 2006, Montamedi 1999) A comparison of distolingual alveolectomy and tooth division techniques favored the former in terms of pocket depth and attachment levels, depending on the position of the impaction in relation to the occlusal plane or cervical line. (Chang 2004),

Guided tissue regeneration (GTR) has not been shown to result in periodontal attachment level gains, pocket depth reduction, or other differences between experimental GTR and control sites. (Oxford 1997, Karapataki 2000, Dodson 2004) There was a tendency for

greater attachment level gains in sites with deep impactions, defined as >6 mm probing depths on the mid-distal surface of the adjacent second molar. (Oxford 1997) The use of demineralized bone powder (DBP) does not appear to offer an advantage, except for patients considered to be at high risk (age \geq 26 yrs., pre-existing attachment loss \geq 3 mm, mesioangular or horizontal impaction), of minimizing development of second molar periodontal defects (Dodson 2004, Dodson 2005). Debridement of the distal root of the second molar at the time of third molar removal has been shown to result in shallower pocket depths post-operatively. (Leung 2005) Scaling and root planing of the exposed root surfaces and post-operative plaque control may have masked the ability to demonstrate an added beneficial effect of GTR or DBP in other than high risk patients. (Oxford 1997, Karapataki 2000, Dodson 2004, Dodson 2005)

Conclusions

- *No single surgical approach to the removal of third molars that will minimize loss of periodontal attachment was identified.*
- *GTR and/or DBP may be beneficial in instances where there is evidence of significant pre-existing attachment loss.*
- *Scaling, root planing, and plaque control have the potential to reduce post-operative loss of attachment.*
- *Further research is needed to clarify under what conditions GTR and/or DBP can contribute to minimizing post-operative periodontal defects.*

Risk Factor: An additional dimension to the topic of periodontal implications of third molars is whether the presence of a third molar, asymptomatic or otherwise, *per se*, influences the risk for adjacent teeth to develop periodontitis.

Unfortunately, the majority of epidemiological studies of periodontal status of adults, as well as studies seeking to assess the validity and reliability of partial mouth examinations, have chosen to exclude third molars, presumably because of a concern for reproducible measurements, a concern recently shown to be unwarranted (Brown 1990, Tu 2004a, 2004b, Bhat 1991, Stoltenberg 1993 and Brown 1996, and Borges-Yanez 2004, Moss 2006). The exclusion of third molars increases the probability for underestimation of the prevalence and severity of periodontitis.

There are at least four (4) types of information that could support a hypothesis that the presence of third molars negatively influences the progression and/or severity of periodontitis effecting adjacent teeth:

- 1) An association of third molars with greater periodontal disease severity.
- 2) An association between the presence of third molars and progressive loss of attachment on non-third molars with emphasis on second molars.
- 3) The influence of third molars on periodontal micro flora, especially the putative pathogens, and on molecular markers of inflammation.
- 4) The effect of third molar removal on 2 and 3 above.

Periodontal Disease Severity: As described above, greater probing pocket depth on second molars adjacent to impacted third molars, before and after third molar removal, has been

reported in individual studies. (Kugelberg 1990) Large national studies, e.g., NHANES III and the Arthrosclerosis Risk in Communities study, found a greater probability of probing pocket depth ≥ 5 mm on the distal of second molars when a visible third molar is present. (Elter 2006, Elter 2005) In similar circumstances, pocket depth ≥ 5 mm has been shown to be associated with loss of attachment ≥ 1 mm. (Blakey 2002) Patients with visible third molars have been shown to have greater overall (absent, mild or severe) levels of periodontal disease severity, based on assessments of pocket depth and bleeding on probing. (Moss 2007)

Periodontal Disease Progression: The presence of third molars has been associated with pocket depth ≥ 5 mm on the distal of the second molar or around third molars in a significant proportion (25%) of patients. (Blakey 2002) Moreover, periodontal disease progression in third molar regions is associated with pocket depth and bleeding on probing at baseline. (Moss 2007) Equally important, non-third molar pocket depth has been shown to be progressive, even though the patients' third molars were asymptomatic. (Blakey 2007) Pocket depth was assessed in patients with 4 asymptomatic third molars followed over an average of 5.9 years and a minimum of 4 years. A significant increase was found in the proportion of subjects with at least 1 pocket ≥ 4 mm in depth in non-third molar regions. This relationship takes on added significance given findings in a 10-year assessment of factors purported to contribute to estimations of prognosis, where molar teeth were 1 of only 3 factors to have prognostic value. (Muzzi 2006)

Bacteria and Mediators of Inflammation: Understanding of the bacterial etiology of periodontitis has evolved from a characterization of the pathogenic sub-gingival flora as simply being composed of predominantly gram-negative organisms, to a set of putative pathogens organized as a biofilm, to a more defined description of clusters of specific bacteria associated with more severe periodontal disease as reflected in deeper pocket depths and bleeding on probing, and refractory disease (Socransky 1998, Socransky 2002). Following the approach developed by Socransky, White found these pathogenic clusters of organisms associated with periodontitis in pockets ≥ 5 mm with loss of attachment at sites on third molars and distal of the second molar in association with asymptomatic third molars in young adults. (White 2002) In addition, biochemical mediators of inflammation were found to be elevated in similar clinical circumstances. (White 2002) Furthermore, when patients with asymptomatic third molars were followed over an average of 2.2 years, an increase in pocket depth of at least 2 mm was found in 24% of patients. (White 2006) The likelihood of change was related to pocket depth ≥ 4 mm and the presence of bacterial complexes associated with periodontitis at baseline.

Treatment: Over 20 years ago Rajasus, et al, reported that total bacterial counts at second molar sites decreased after extraction of adjacent visible asymptomatic third molars. (Rajasus 1993) The organisms were identified as "Black-pigmented" gram-negative bacteria and *Actinobacillus actinomycetemcomitans*. The authors postulated that erupting third molars might harbor bacteria that could be harmful to adjacent teeth and the removal of third molars could eliminate potential foci of infection. This concept received little attention until 1996 when elevated bacterial counts were reported to occur in first molar and second molar sites in association with symptomatic visible third molars. (Blakey 1996) Treatment of the third molar reduced symptoms but not the bacterial counts. Following removal, microbial counts

decreased further but not to levels of the controls. Furthermore, scaling and root planing did not result in comparable reductions in total counts of periodontal pathogens for patients with visible third molars as compared to patients without third molars. (Moss 2007)

Conclusions

- *The presence of visible third molars is associated with overall elevated levels of periodontitis and that of immediately adjacent teeth.*
- *In the presence of visible third molars, periodontitis involving adjacent teeth is progressive and only partially responsive to therapy.*
- *The evaluation of a visible third molar for removal should include an assessment of the periodontium associated with both the third molar itself and that of adjacent teeth, and include anatomical limitations to mechanical removal of plaque. The presence of pocket depths of $\geq 4-5$ mm and/or bleeding on probing should be recognized as possible predictors of future progression of periodontitis.*
- *The association of overall increased disease severity in the presence of visible third molars, the progressive nature of periodontitis involving non-third molars when third molars are present, the relationship between visible third molars and bacteria associated with severe and refractory periodontitis, and the negative impact of visible third molars on treatment outcomes all lend support to the hypothesis that third molars should be considered as a possible predictor of periodontitis.*
- *Third molars should be included in studies of periodontal disease prevalence and severity, and in studies assessing factors that may indicate an increased risk for periodontal disease.*

3. The Microflora Around the Second and Third Molars

Inflammation of enveloping mucosa and gingiva are frequently associated with the eruption of third molars. Pericoronitis, an acute infection with clinical symptoms including pain, swelling, erythema, and purulence are not uncommon. In the majority of cases the flora found in an anaerobic atmosphere predominates. The bacteria most commonly detected are α -hemolytic streptococci and the genera *Prevotella*, *Veillonella*, *Bacteroides* and *Capnocytophaga*, all of which can be detected in the gingival crevice surrounding third molars or adjacent teeth. (Sixou 2003) The microbiologic flora associated with pericoronitis is diverse, with over 440 microorganisms implicated, including obligate anaerobic bacteria and facultative anaerobic microflora, which result in suppurative infections. (Peltroche-Llacsabuanga 2000) Pericoronitis can progress to significant life threatening infections. Treatment must be employed to limit morbidity and mortality. Accepted treatment regimens include antibiotic therapy coupled with surgical intervention. Surgical removal of the tooth associated with the infection is curative.

The absence of clinical symptoms (asymptomatic) does not indicate absence of disease or pathology. Microbial complexes (“red” and “orange” complex species) associated with periodontal pathology have been detected in the second molar/third molar region in patients with asymptomatic third molars. (White 2002a) These same subgingival microbial profiles have been associated with periodontitis refractory to periodontal therapy. (Socransky 2002)

The presence of inflammatory mediators (Prostaglandin E₂, Interleukin 1 β) in the gingival crevicular fluid are markers of chronic oral inflammation and have been shown to be associated with periodontitis, which is diagnosed by the presence of periodontal probing depths > 5 mm in the third molar region with associated periodontal attachment loss. (White 2002b) The clinical findings of increased periodontal probing depths and periodontal attachment loss, coupled with colonization of periodontal pathogens, support the concept that clinical and microbial changes associated with the initiation of periodontitis may present first in the third molar region (White 2002a). There is also evidence that chronic oral inflammation leads to a progression of periodontal disease in the third molar region over time. (White 2006) Pathology, as detected by these measures, exists in the third molar area without symptoms noticed by the individual affected.

Periodontal disease progresses in the second molar and third molar region over time in subjects with asymptomatic third molars. Probing depths increased, which indicated a deteriorating periodontal condition. (Blakey 2006) In older adults, visible third molars have been associated with more severe periodontal conditions, including an increased risk of probing depths of \geq 5 mm on adjacent second molars, which suggests progression of disease without symptoms. (Elter 2005)

Third molar periodontal pathology and resultant inflammation may have a negative systemic impact as indicated by research on obstetric outcomes in individuals with asymptomatic retained third molars. (Moss 2006)

Conclusions

Data on microflora and asymptomatic disease in the third molar region show:

- *Absence of symptoms does not indicate absence of disease or pathology.*
- *Pathogenic bacteria (red and orange complexes) in clinically significant numbers exist in and around asymptomatic third molars.*
- *Periodontal disease as indicated by probing depths \geq 4 mm exists in and around asymptomatic third molars.*
- *Indicators of chronic inflammation exist in periodontal pockets in and around asymptomatic third molars.*
- *Periodontal disease progresses in the absence of symptoms.*

4. The Effects of Age on Various Parameters Relating to Third Molars

Symptomatology and Age: A study of 1,151 patients from 13-69 years of age with third molars showed that of those who had symptoms, pain was the most common symptom (35.3%), followed by swelling (21.7%), discomfort from food impaction (3.6%), and purulent discharge (3%). (Punwutikorn 1999) The frequency of each increased generally with age. Slade also noted that 37% of patients presenting with wisdom tooth problems reported pain and swelling as the indication for seeking treatment. (2004) Additionally, this study noted that Health Related Quality of Life indicators were reported more frequently as patients got older.

