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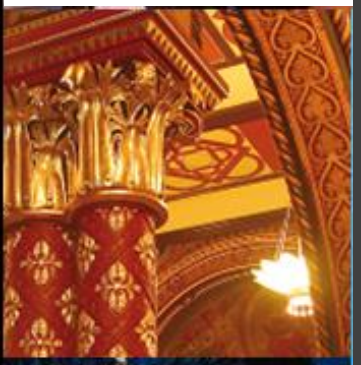


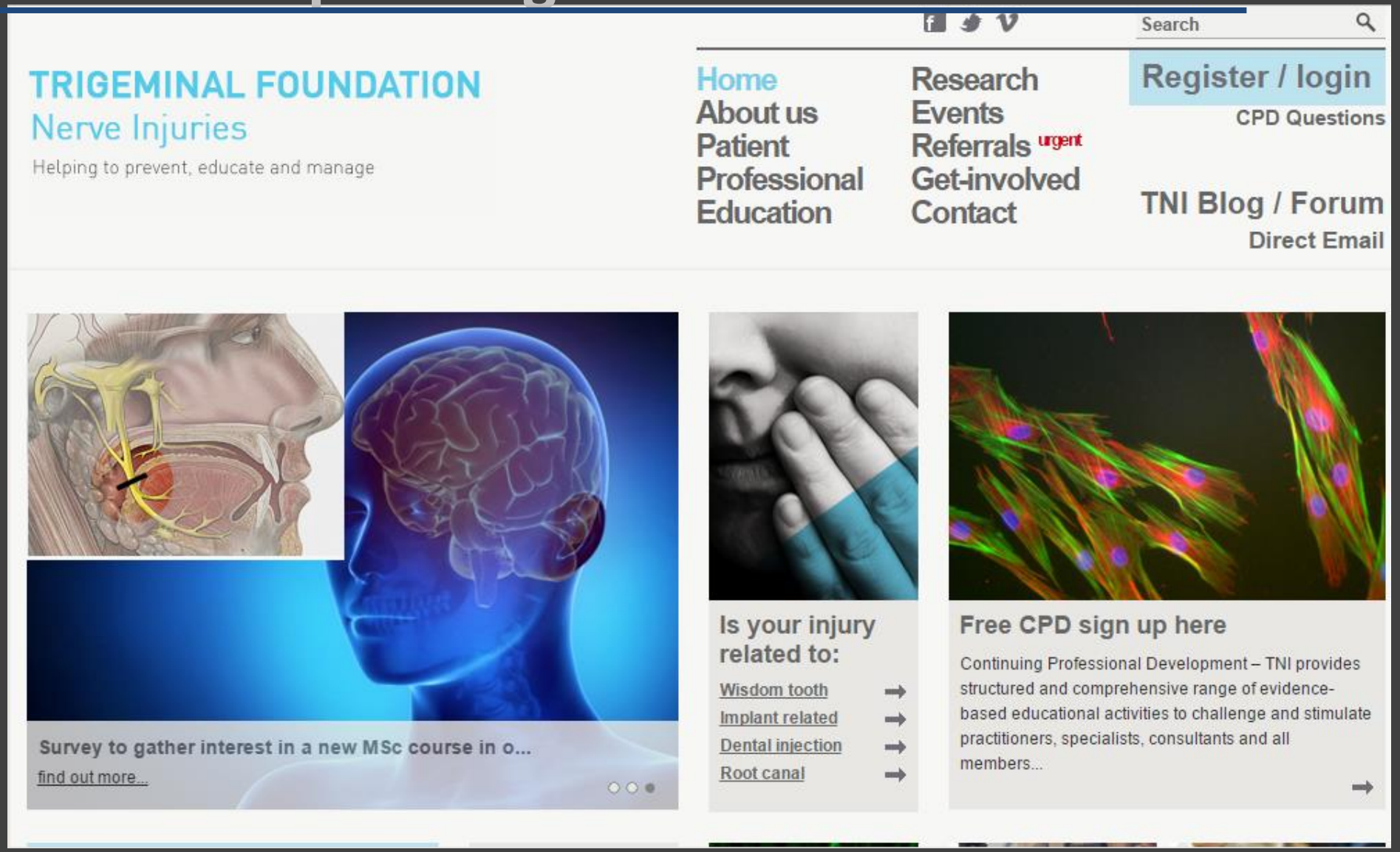
Where is the wisdom in third molar surgery?

Guidance? Timing? Risk Management? What technique?

Tara.renton@kcl.ac.uk

Sydney 2017

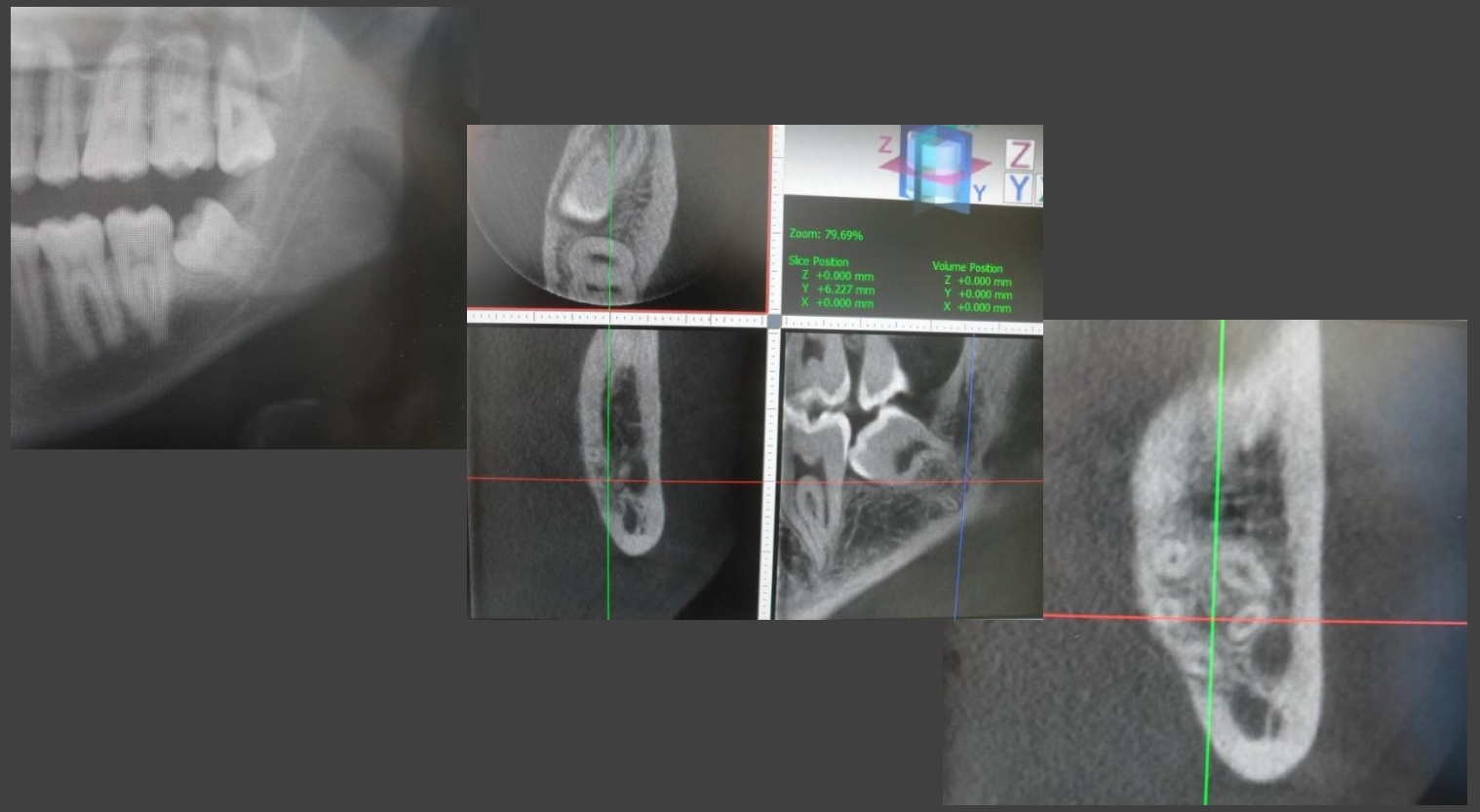
Trigeminalnerve.org.uk
Orofacialpain.org.uk



Objectives

The objective of this conversation is to update the delegate in current evidence in third molar risk assessment and management including;

- Guidance on indications for M3M surgery?
- Timing of surgery
- Risk assessment
- What surgical technique
  - Routine ?
  - Modified/ Coronectomy ?



Overview

- Guidance for surgery
  - Timing of intervention
- Risk Assessment
  - Patient expectations and consent
  - Assessment
    - Patient factors
      - Medical
      - Social
      - Psychological
    - Difficulty and risk of surgery
    - Surgical technique
    - When is a coronectomy needed?
- Surgical technique & follow up

Overview

- Guidance for surgery
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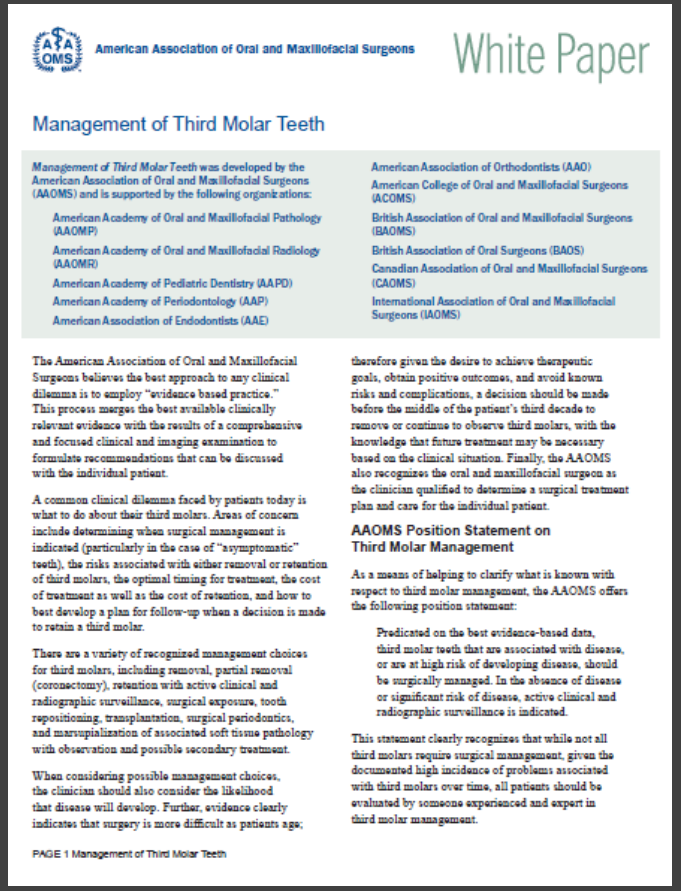
    - When is a coronectomy needed?
- Surgical technique & follow up

Guidelines and Guidance for M3M intervention?

- Narrative review of M3M guidelines identified 21 National Guidance (including guidelines and systematic reviews)
- Assessed guidelines against AWMF criteria for drawing up guidelines
  - None fulfilled all AWMF criteria
- Most focussed on a particular aspect
  - NICE impacted m3Ms only
  - Cochrane interventions
  - Spanish, Dutch, German, AAOMS Indications only
- The optimal evidenced guidance provided by;
  - BMJ Evidence M3M Dodson 2014
  - Swedish HTA 2011
  - *French National Guidance 2009*
  - Cochrane Coulthard et al 2012 but limited to techniques only
  - *NICE BUT limited only to impacted M3Ms 2000*



American Association of Oral and Maxillofacial Surgeons

White Paper

Management of Third Molar Teeth

Management of Third Molar Teeth was developed by the American Association of Oral and Maxillofacial Surgeons (AAOMS) and is supported by the following organizations:

- American Academy of Oral and Maxillofacial Pathology (AAOMP)
- American Academy of Oral and Maxillofacial Radiology (AAOMR)
- American Academy of Pediatric Dentistry (AAPD)
- American Academy of Periodontology (AAP)
- American Association of Endodontists (AAE)
- American Association of Orthodontists (AAO)
- American College of Oral and Maxillofacial Surgeons (ACOMS)
- British Association of Oral and Maxillofacial Surgeons (BAOMS)
- British Association of Oral Surgeons (BAOS)
- Canadian Association of Oral and Maxillofacial Surgeons (CAOMS)
- International Association of Oral and Maxillofacial Surgeons (IAOMS)

The American Association of Oral and Maxillofacial Surgeons believes the best approach to any clinical dilemma is to employ "evidence based practice." This process merges the best available clinically relevant evidence with the results of a comprehensive and focused clinical and imaging examination to formulate recommendations that can be discussed with the individual patient.

A common clinical dilemma faced by patients today is what to do about their third molars. Areas of concern include determining when surgical management is indicated (particularly in the case of "asymptomatic" teeth), the risks associated with either removal or retention of third molars, the optimal timing for treatment, the cost of treatment as well as the cost of retention, and how to best develop a plan for follow-up when a decision is made to retain a third molar.

There are a variety of recognized management choices for third molars, including removal, partial removal (coronectomy), retention with active clinical and radiographic surveillance, surgical exposure, tooth repositioning, transplantation, surgical periodontics, and marsupialization of associated soft tissue pathology with observation and possible secondary treatment.

When considering possible management choices, the clinician should also consider the likelihood that disease will develop. Further, evidence clearly indicates that surgery is more difficult as patients age; therefore given the desire to achieve therapeutic goals, obtain positive outcomes, and avoid known risks and complications, a decision should be made before the middle of the patient's third decade to remove or continue to observe third molars, with the knowledge that future treatment may be necessary based on the clinical situation. Finally, the AAOMS also recognizes the oral and maxillofacial surgeon as the clinician qualified to determine a surgical treatment plan and care for the individual patient.

AAOMS Position Statement on Third Molar Management

As a means of helping to clarify what is known with respect to third molar management, the AAOMS offers the following position statement:

> Predicated on the best evidence-based data, third molar teeth that are associated with disease, or are at high risk of developing disease, should be surgically managed. In the absence of disease or significant risk of disease, active clinical and radiographic surveillance is indicated.

This statement clearly recognizes that while not all third molars require surgical management, given the documented high incidence of problems associated with third molars over time, all patients should be evaluated by someone experienced and expert in third molar management.

PAGE 1 Management of Third Molar Teeth

What do the international M3M guidelines tell us?

1. AAOMS	2008
2. German dentists	2006
3. Australian military	2002
4. Malaysian	2005
5 Croydon uk	*2007*
6. England Local Worcestershire	*2004*
7. Scotland [SIGN]	1999
8. Finland	2009
9. Norway	2008
10. England NICE	2000
11. American public health	2010
12. European guidelines for specialty training	2003
13. South african society OMFS	2002
14. New zealand review of practice	2001
15. Italian TMS guidelines	2012
16. Pain control anxiety TMS	2000
17. US military	2010
18, US coast guard	2005
19. Spain	2009
20. Brit Perio society parameters of care	2001
21. Cochrane rev	2016
22. FDS RCS Third Molar guidelines	1997
23. UK military	?
24. Danish TMS guidelines	2009
25. Dutch syst review	2005
26. US dental schools TMS 2008	
27. Belgium syst review TMS KCE_182C_wisdom_teeth	

- 96% of guidelines recommend indications for surgery ONLY
- 5% mention anaesthesia
- 34% also recommend adjunctive care parameters
  - Sedation
  - Antibiotic use
  - Analgesia
  - Socket irrigation

Different culture, different language and different wisdom?

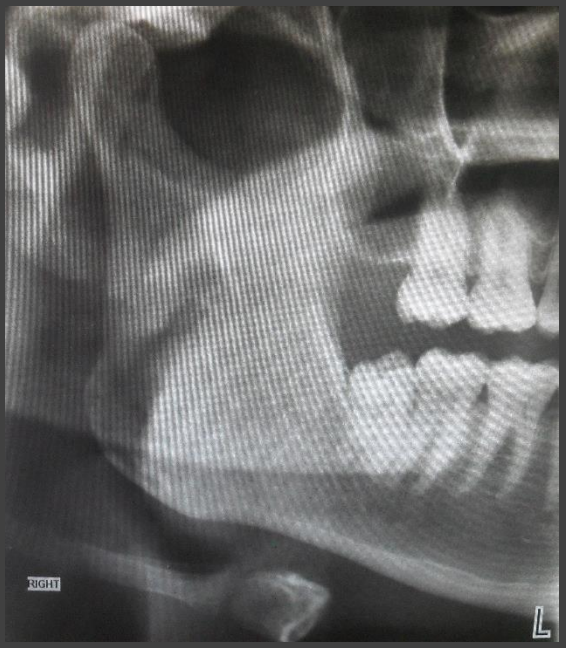
- In Dutch, UK, USA **wisdom tooth**
- In Arabic, Hindi **tooth of maturity**
- In Spanish **The Judgement Molar**
- In Canada **The last tooth**
- In Korean, **pain of the first love**
- In Japanese, **unknown to the parents**
- In Serbian, **mind tooth**
- In Thai **huddling tooth**
- In Turkish **20th year tooth**
- In Greek "Φρονιμίτης" (fronemEtis) or "σωφρονιστήρας" meaning the disciplinarian, someone who demands conformity to rules and forms.

Diagnosis? Get it right!

- Listen
- Patient factors
- Systemic risks

4 possible clinical presentation scenarios

Possible treatment and diagnostic indications	**<u>Interventional removal of M3M communicating with the mouth</u>** **Earlier age -less morbidity** Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	**<u>Leave M3M OR Prophylactic removal of M3M</u> indications include;** Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease (Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
Asymptomatic	**Diseased**	**Non Diseased**
Symptomatic	**Diseased**	**Non Diseased** **M3M healthy but disease in adjacent tissues causing pain**
Possible Treatment and diagnostic indications	**<u>Therapeutic removal of M3M</u>** **Treat pathology may include**; pathology may include; Periodontal disease, caries, resorption, tooth fracture, cysts or other pathology	**<u>No removal of M3M</u>** **Treat pathology may include;** TMD, mucosal disease, adjacent tooth pathology, salivary gland disease



Variable recommendations regarding intervention

‘Take them out versus leave them in’

Active surveillance or clinical review

Therapeutic removal

Interventional and or Prophylactic removal

Removal of all 8s

Low to no intervention

High intervention

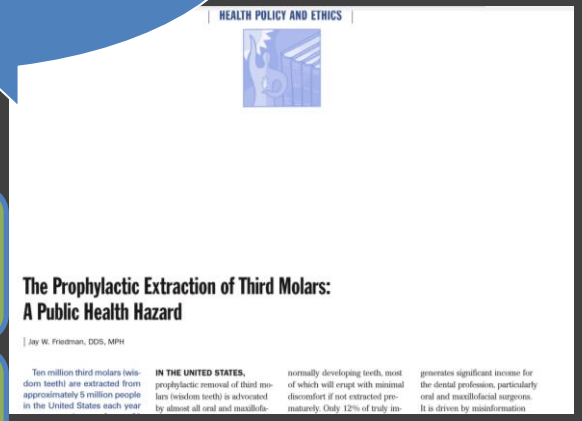
NICE Guidelines UK 2000

Finnish Guidelines 2009

AAOMS 2012, 2016

Military Guidelines US UK Canada Australia

AAOMS 2010 PROPHYLAXIS



HEALTH POLICY AND ETHICS

The Prophylactic Extraction of Third Molars: A Public Health Hazard

Jay W. Friedman, DDS, MPH

Ten million third molars (wisdom teeth) are extracted from approximately 5 million people in the United States each year

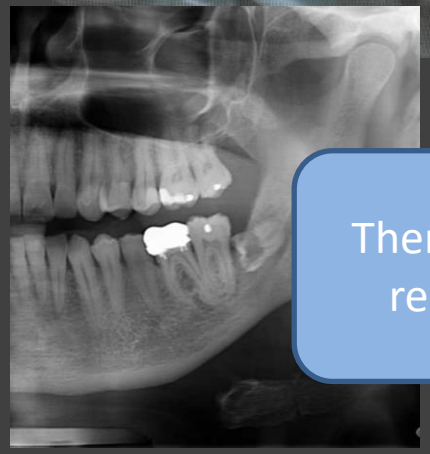
IN THE UNITED STATES, prophylactic removal of third molars (wisdom teeth) is advocated by almost all oral and maxillofa-

normally developing teeth, most of which will erupt with minimal discomfort if not extracted prematurely. Only 12% of truly im-

generates significant income for the dental profession, particularly oral and maxillofacial surgeons. It is driven by misinformation

Renton T, Al-Haboubi M, Pau A, Shepherd J, Gallagher JE. What has been the United Kingdom's experience with retention of third molars? J Oral Maxillofac Surg. 2012 Sep;70(9 Suppl 1):S48-57. doi: 10.1016/j.joms.2012.04.040. Epub 2012

4 possible clinical presentation scenarios

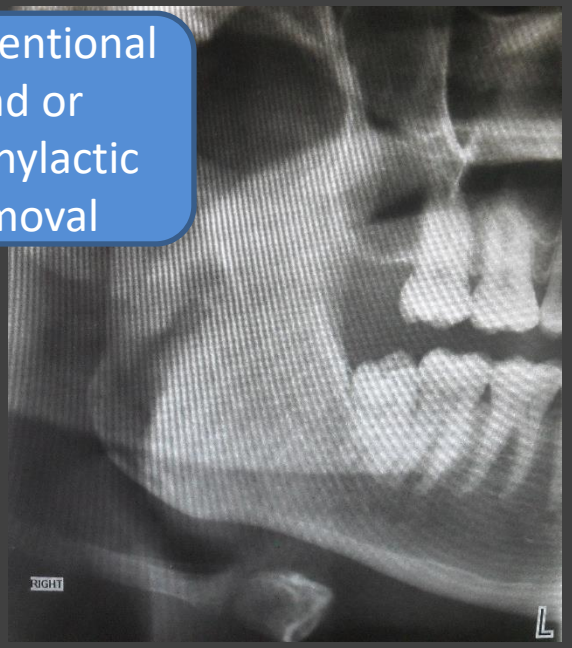


Therapeutic removal

Therapeutic removal

Active surveillance or clinical review

Interventional and or Prophylactic removal



Removal of all 8s

Possible treatment and diagnostic indications	**<u>Interventional removal of M3M communicating with the mouth</u>** **Earlier age -less morbidity** Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	**<u>Leave M3M OR Prophylactic removal of M3M</u> indications include;** Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease (Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
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Compliance with guidance?

- Working in the NHS it is a statutory duty to comply with NICE TA1 Guidance.
- Unless you can justify otherwise!

Eur J Oral Sci 2005; 113: 349–354
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European Journal of Oral Sciences

Effectiveness of clinical practice guideline implementation on lower third molar management in improving clinical decision-making: a randomized controlled trial

Wil J. M. van der Sanden[1], Dirk G. Mettes[1], Alphons J. M. Plasschaert[1], Richard P. T. M. Grol[2], Jan Mulder[3], Emiel H. Verdonschot[1]

[1]Department of Preventive and Restorative Dentistry, College of Dental Sciences, [2]Centre for Quality of Care Research (WOK), [3]Department of Information and Statistics, Radboud University Nijmegen Medical Centre, Nijmegen, the Netherlands

van der Sanden WJM, Mettes DG, Plasschaert AJM, Grol RPTM, Mulder J, Verdonschot EH. Effectiveness of clinical practice guideline implementation on lower third molar management in improving clinical decision-making: a randomized controlled trial. Eur J Oral Sci 2005; 113: 349–354. © Eur J Oral Sci, 2005

The objective of this study was twofold, namely to evaluate the effectiveness of a dental clinical practice guideline on the management of asymptomatic impacted lower third molars (i) on referral rates and (ii) on dentists' changes in knowledge. A two-arm cluster randomized controlled trial, with pre- and post-test assessments, was conducted. A guideline was implemented by multifaceted interventions (i.e. feedback, reminders, and an interactive meeting). The effect was evaluated after 1 yr by repeating the baseline questionnaire and by monitoring the number of patients who were referred for removal of their asymptomatic impacted mandibular third molars. Instruments were questionnaires for detecting changes in knowledge, patient records, and panoramic radiographs. The knowledge of dentists regarding asymptomatic mandibular third molar management was found to increase significantly in the intervention group as compared to the control group. There was no statistically significant difference between the groups in guideline-consistent patient referral rates at the post-test assessment. It was concluded that the methodology employed for dissemination and implementation of a clinical practice guideline on asymptomatic mandibular third molar management improves dentists' knowledge on this topic and is effective in improving decision-making in simulated cases; however, no clinical effect was demonstrated.

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Key words: clinical practice guidelines; decision-making; implementation; third molars
Accepted for publication June 2005

The removal of asymptomatic, impacted mandibular third molars is common as these teeth have been associated with various types of pathology (1). Their removal has therefore been named 'prophylactic', but recent literature indicates that pathological processes caused by impacted third molars have been grossly overestimated (2, 3) and that, in general, asymptomatic third molars should be left untouched (1). Other studies have demonstrated considerable intra- and interdentist variation regarding decisions to remove or retain asymptomatic, impacted mandibular third molars (2, 4). The transfer of new evidence into daily dental practice obviously still needs improvement (5).

Quality of care and clinical practice guidelines (CPG) have gained an increased interest in many areas of healthcare (6). CPGs can be defined as systematically developed statements to assist the practitioner and the patient in making decisions about appropriate healthcare in specific clinical situations (7). CPGs have increasingly been seen as powerful tools for using to improve the quality of healthcare and to change professional performance by guiding decision making, particularly in areas of clinical uncertainty. Much time and resources have been spent on the development of CPGs, but relatively little attention has been devoted to measure their effectiveness when applied in routine clinical practice (8). Traditional ways to improve professional performance (e.g. studying scientific literature and educational materials, and attending conferences) have resulted in only moderate changes in practitioners' performance (9–11). Other interventions have been advocated to influence clinical performance, such as a multifaceted active approach, in which feedback, reminders, and interactive education are combined with guideline dissemination and implementation (10, 12–15).

In dentistry, only a few structured efforts have been made to develop, implement, and evaluate CPGs (16). Further research into scientific methods for the development, implementation, and evaluation of dental CPGs has therefore been recommended (17, 18), as general dental practitioners (GDPs) acknowledge that CPGs provide support in clinical decision making (16). Recent

Overview

- Indications for surgery
  - Timing of intervention
- Risk Assessment
  - Patient expectations and consent
  - Assessment
    - Patient factors
      - Medical
      - Social
      - Psychological
    - Difficulty and risk of surgery
    - Surgical technique
    - When is a coronectomy needed?
- Surgical technique & follow up

M3M indications-surveillance

<u>Clinical review or Active Surveillance</u> is recommended for those patients with unerupted (non oral communicating) or functional M3Ms that are asymptomatic and disease free (Approx 23%)

- AAOMS 2016
- Draft RCS Parameters of care using 'Clinical review' 2017
- NICE 2017
- HTA Sweden
- BMJ Evidence

No evidence level

TABLE 1—Pathologies and Pericoronitis Associated With Impacted Third Molars

Pathology	Percentage Affected
Internal resorption	0.85
Cysts	1.65
Periodontal bone loss	4.72
Resorption on distal surface of second molar	4.78
Pericoronitis	8
Total	20

Source. See references 3, 5, 7, and 8.

Possible treatment and diagnostic indications	**<u>Interventional removal of M3M communicating with the mouth</u> Earlier age -less morbidity** Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	**<u>Leave M3M OR Prophylactic removal of M3M</u> indications include;** Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease (Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
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BUT Leaving M3Ms in leads to…….

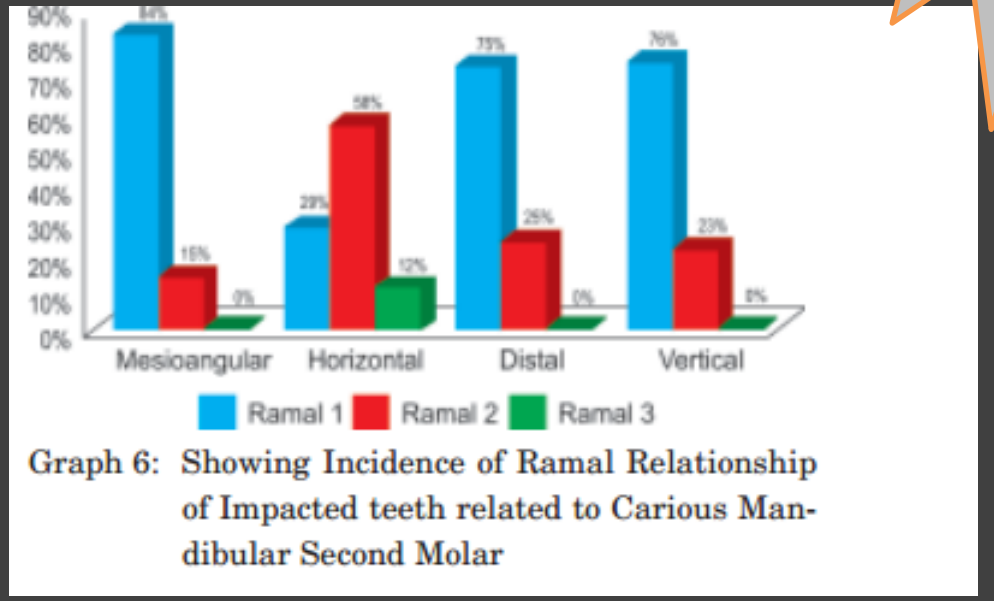
Distal M2M caries and surgery in older patients

35-48% of indicated treatment in London and Manchester

Risk factors Angulation of teeth and partial eruption

Age increase at surgery with increased morbidity

Medium evidence level
4 Prospective cohort trials



Graph 6: Showing Incidence of Ramal Relationship of Impacted teeth related to Carious Mandibular Second Molar

What has been the United Kingdom's experience with retention of third molars?**Renton T**, Al-Haboubi M, Pau A, Shepherd J, Gallagher JE. J Oral Maxillofac Surg. 2012 Sep;70(9 Suppl 1):S48-57. doi: 10.1016/j.joms.2012.04.040. Epub 2012

Mansoor J, Jowett A, Coulthard P. **NICE or not so NICE?** Br Dent J. 2014 Jun 13;216(11):621.

M3M indications- prophylactic

Healthy tooth but unhealthy patient

- Medical indications for patients undergoing planned treatments that may complicate likely surgery of M3M including; pharmaceutical (Bisphosphonates, antiangiogenics or chemotherapy) and radio therapy.

Medium evidence level
4 Prospective randomised trials

- Necessary surgery in the M3M site including; mandibular fractures, orthognathic surgery and excision of disease including neoplasia (both benign and malignant lesions) and cystic lesions

AAOMS 2016, BMJ Evidence
Draft RCS Parameters of care using 'Clinical review' 2017
NICE 2017

Kings C

Possible treatment and diagnostic indications	Interventional removal of M3M communicating with the mouth Earlier age -less morbidity Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	Leave M3M OR Prophylactic removal of M3M indications include; Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease (Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
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Moacir Guilherme da Costa et al.,
Is there justification for prophylactic extraction of third molars? A systematic review. Braz. oral res. vol.27 no.2 São Paulo Mar./Apr. 2013

Medium evidence level
4 Prospective randomised trials

RESULTS

The search strategy yielded 260 papers. Four studies qualified for the final analysis (Table 3), following a selection based on the preestablished eligibility criteria. The complete texts of these papers were obtained for analysis.

Table 3 Studies selected.

Author	Study groups	Sample	Age	Measurement method	Results
Mettes *et al.* (2005) [27]	Systematic review assessing the effect of prophylactic extraction of third molars in adolescents and adults, in comparison to non-intervention	–	–	Searches in Medline and Cochrane through August 4, 2004; randomized or controlled clinical trials were selected	No evidence was found to supp refute the routine prophylac extraction of asymptomatic imp third molars
Van der Sanden *et al.* (2005) [26]	Dental students who received a clinical practice guide for the management of asymptomatic third molars	36 impacted lower third molars; 102 students participated in the study (51 in each group—test and control); randomized selection	Three age groups: 19–25, 26–40 and 41–60 years	The intervention and control groups received a questionnaire, and the data were submitted to analysis of co-variance and the chi-square test	The use of a clinical practice gu the management of asymptor third molars is effective and enh the decision-making process dental surgeons
Harradine *et al.* (1998) [22]	Randomized allocation of post-treatment orthodontic patients submitted to extraction of lower third molars to monitor the effect of the extractions on crowding of the lower incisors	Total of 164 (90 women and 74 men)	14 years and 10 months for participation in the study, with 66 months of follow-up	Patients were allocated based on a list, and were contacted after 5 years. Models were constructed, measurements were made and data were submitted to the Minitab program and GLIM statistical software	No significant differences in l incisor crowding were found be patients from whom third molar extracted and those on whon intervention was performed; thu prophylactic extraction of third is not justified
Lindqvist and Thilander (1982) [23]	Randomized allocation of patients submitted to extraction of third molars removed on one side and maintained on the other side (control); after three years, radiographs were taken and study models were made	23 boys and 29 girls with impacted third molars on both sides of the mandible	15.5 years; range: 13 to 19 years	Radiographs and study models	No conclusions were made reg which patients should underg anticipated extraction of third m to prevent late crowding; howe cases of severe crowding, third extraction may be indicate

Quality of the studies

A medium degree of quality and methodological consistency was found in three studies and low quality was found in one study (Table 4). No studies showed a high degree of consistency. The most significant flaw was an inadequate sample size. Other flaws included the failure to declare the blinded assessment of the measurements and confounding factors. Only one paper adequately described the method of error analysis.

Table 4 Quality evaluation of the studies retrieved.

Articles	Study design	Sample size	Selection description	Valid measurement methods	Method of error analysis	Blinding in measurement	Adequate statistics provided	Confounding factors considered	Quality standard judgement
Mettes *et al.* (2005) [27]	RCT	Inadequate	Adequate	Yes	No	No	No	ND	Low
Van der Sanden *et al.* (2005) [26]	RCT	Inadequate	Adequate	Yes	No	ND	Yes	ND	Medium
Harradine *et al.* (1998)	RCT/P	Inadequate	Adequate	Yes	Yes	ND	Yes	ND	Medium
Lindqvist and Thilander (1982) [23]	RCT	Inadequate	Adequate	Yes	No	No	Yes	ND	Medium

CCT: controlled clinical trial; RCT: randomized clinical trial; CT: clinical trial; L: longitudinal; P: prospective; ND: not declared.

Abstract Vancouver HTA Nov2017

Potential cost saving of selected prophylactic surgery in UK is approximately £20K

Removal of Third Molars Versus Watchful Waiting: A Cost-Effectiveness Analysis

Introduction

Treatment options for people with impacted mandibular third molars (IM3Ms) include either removal or retention with standard care (watchful waiting). We appraised the comparative cost-effectiveness of these two strategies in a population with pathology-free or trouble-free IM3Ms.

Methods

We constructed an economic model with a time horizon of 50 years. Costs and quality adjusted life years (QALYs) were considered from the perspective of the UK NHS and discounted at an annual rate of 3.5%. The model pathways, and the assumptions underpinning the model, were determined through consultation with clinical experts and review of the clinical and economic literature. Clinical evidence was mainly extracted from published cohort studies undertaken in Scotland and Wales.

Results

Our model estimated the incremental cost-effectiveness ratio (ICER) per quality QALY gained for the comparison of prophylactic removal versus watchful waiting to be £11,741 per QALY gained for people aged 20 with asymptomatic IM3Ms. The incremental cost per person associated with prophylactic extraction was £55.71 with an incremental QALY gain of 0.005 per person. With such a small difference in costs, the level of confidence in the utilities associated with each of the strategies gains importance. Although direct utility evidence around IM3M symptoms was lacking, suitable proxies were found and the cost-effectiveness results were robust across a range of values.

Conclusions

Result[illegible]om cohort studies suggest that, under the current Scottish Inter[illegible]legiate Guidelines Network and National Institute for Health and Care Excellence guidelines for watchful waiting, extraction rates for IM3Ms in the UK could be as high as 5.7% per year, meaning that the majority of people with IM3Ms will have the impacted tooth removed at some point. Given the complications that can arise with IM3Ms, our results suggest that prophylactic removal may be the more cost-effective strategy with ICERs per QALY gained being consistently <£20,000.

M3M indications – Therapeutic (NICE 2000)

Therapeutic interventions

- Pericoronitis or M3M (when eruption into a functional position is unlikely).
- Caries of M3M or M2M to assist M2M restoration
- Periodontal disease compromising prognosis of M2M or M3M
- Resorption of M3M or M2M
- Dental trauma/ fracture resulting in poor prognosis of M3M

NICE 2000, FDS RCS Parameters of care 1997, AAOMS,2010-2016, Finnish, German, Spanish, Canadian and Malaysian guidelines

Low evidence level
4 Prospective cohort trials

Possible treatment and diagnostic indications	Interventional removal of M3M communicating with the mouth Earlier age -less morbidity Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	Leave M3M OR Prophylactic removal of M3M indications include; Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease (Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
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M3M indications - interventional

Interventional extractions for non functional M3Ms communicating with the oral cavity (completely or partially erupted**) @ LOW RISK of IANI** in order to prevent;

- Pericoronitis
  - Remove vertical teeth before 25 years of age if M3Ms
- Bone defects
  - Remove horizontal teeth before 25-30 years of age if M3Ms
- Nerve injury
  - Remove all close to canal before root completed before 19-21 years of age
- Caries
  - Remove partially erupted

Low-medium evidence level
6 Prospective cohort trials

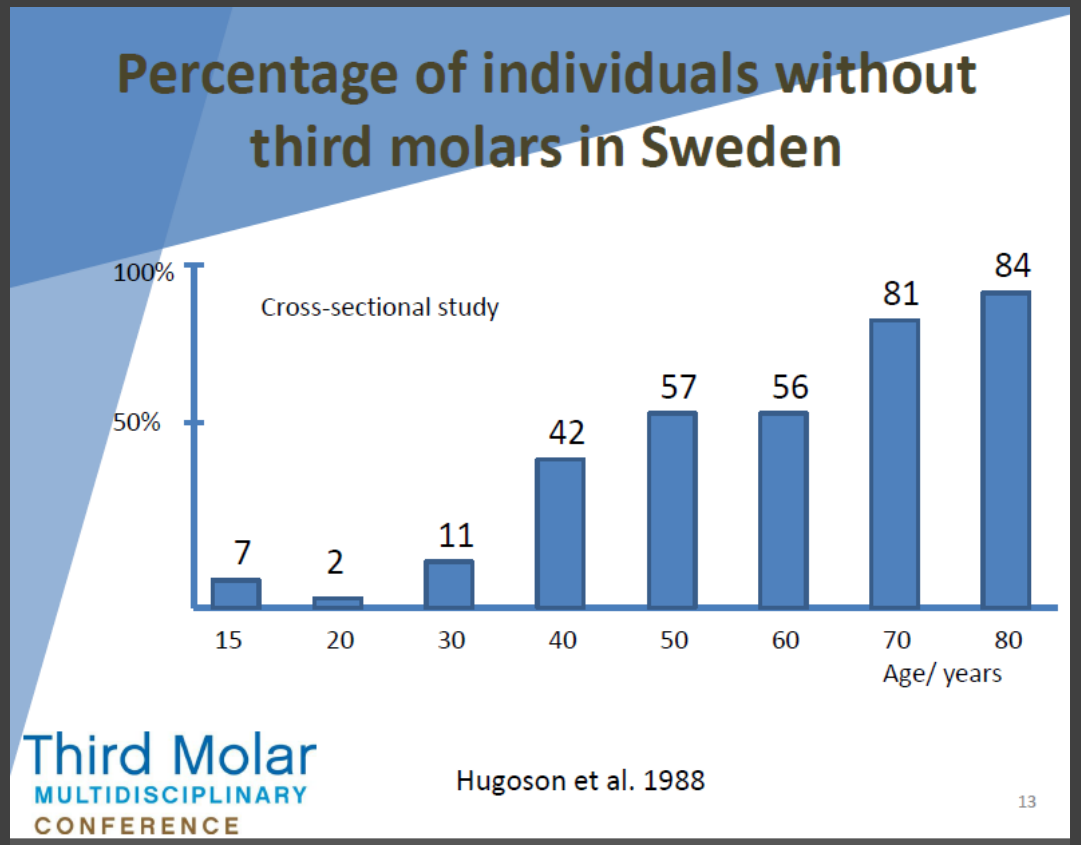
Possible treatment and diagnostic indications	Interventional removal of M3M communicating with the mouth Earlier age -less morbidity Quiescent pathology may include; Periodontal disease, caries, resorption, tooth fracture, jaw fracture, cysts or other pathology	Leave M3M OR Prophylactic removal of M3M indications include; Pre radiotherapy Pre medication for osteoporosis or metastatic bone disease Bisphosphonates, antiangiogenics M3M removal in line of surgery for jaw fracture, orthognathic or cancer surgery
Asymptomatic	Diseased	Non Diseased
Symptomatic	Diseased	Non Diseased M3M healthy but disease in adjacent tissues causing pain
Possible Treatment and diagnostic indications	Therapeutic removal of M3M Treat pathology may include; pathology may include; Periodontal disease, caries, resorption, tooth fracture, cysts or other pathology	No removal of M3M Treat pathology may include; TMD, mucosal disease, adjacent tooth pathology, salivary gland disease

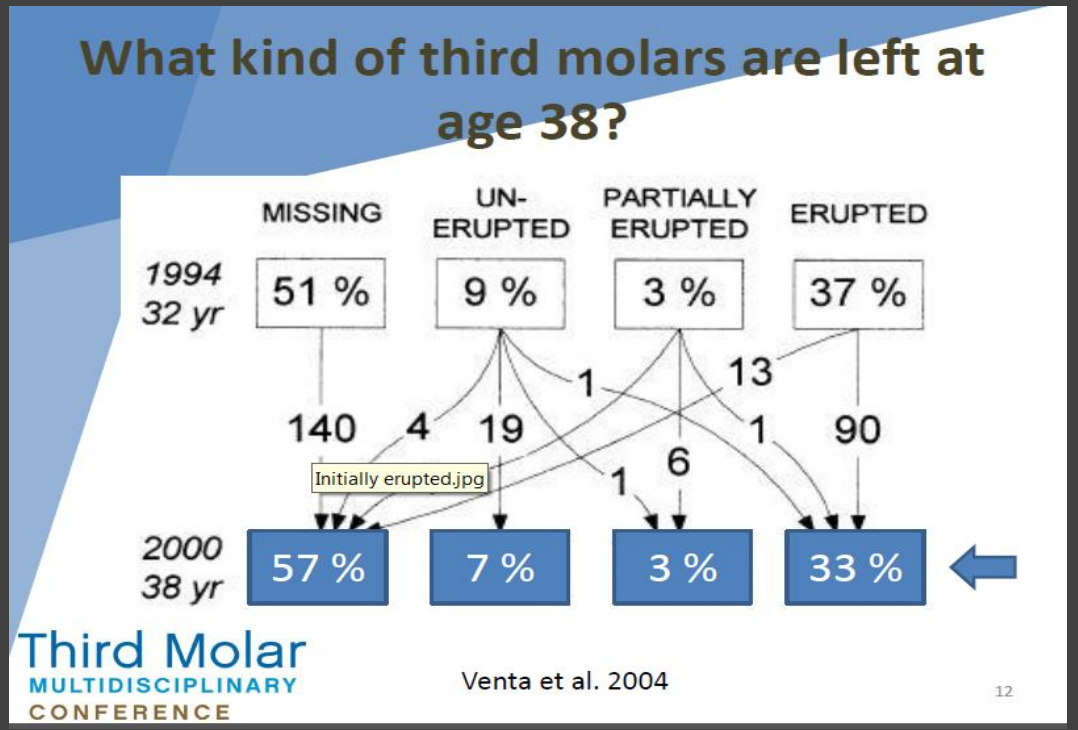
AAOMS,2010-2016, Finnish, German, Spanish, Canadian, French, Dutch and Malaysian M3M guidelines

Take them out lobby because…….

Most patients have their M3Ms removed by 70 years anyway and there is less morbidity removing them when younger

Prospective cohort trials in Finland, Sweden, USA and Brazil



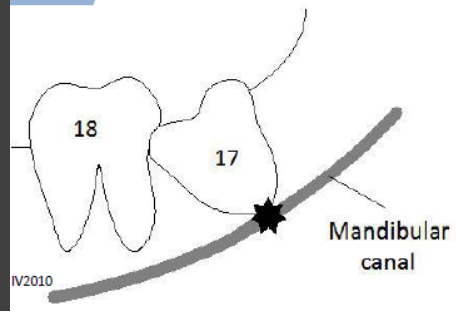


Is the timing of the intervention important?

- Finnish Recommendations

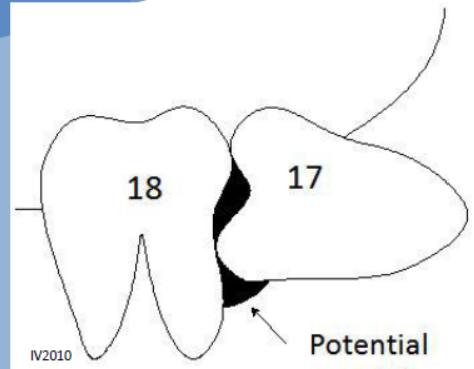
Irja Venta et al 2015

Incomplete root close to nerve



- Should be removed before the 2/3 stage of development of the root

Horizontal superficial teeth



- Should be removed before the age of 25-30 years (Kugelberg 1990, 1991)

Risk with incomplete root close to nerve

- Risk of inferior alveolar nerve injury if removed later
- Risk of symptoms (pain, numbness) if roots continue to grow

Key evidential points

Only 11 studies!

Dodson TB, Susarla SM. **Impacted wisdom teeth.** BMJ Clin Evid. 2014 Aug 29;2014. pii: 1302.

- Impacted wisdom teeth (third molars) occur because of a lack of space, obstruction, or abnormal position.
- They can cause pain, swelling, and infection, and may destroy adjacent teeth and bone.
- **The incidence** of impacted wisdom teeth is high, with some **72% of Swedish people aged 20 to 30 years** having at least one impacted wisdom tooth.
- Non-RCT evidence indicates that about **33% of asymptomatic**, unerupted wisdom teeth will change position, resulting in wisdom teeth that are partially erupted but non-functional or non-hygienic.
- Between **30% and 60% of people who retain their asymptomatic wisdom teeth proceed to extraction** of one or more of them between 4 and 12 years after their first visit.
- Removal of impacted wisdom teeth (symptomatic and asymptomatic) is a commonly performed procedure.
- While symptomatic or diseased impacted wisdom teeth should be recommended for removal, current evidence neither refutes nor confirms the practice of prophylactic removal of asymptomatic, disease-free wisdom teeth
- Some non-RCT evidence indicates that extraction of the asymptomatic tooth may be beneficial when disease, such as caries, is present in the adjacent second molar, or if periodontal pockets are present distal to the second molar.
- We do not know whether active surveillance is effective for asymptomatic, disease-free wisdom teeth, as we found no RCTs or prospective cohort studies on this topic.
- We don't know which is the most effective operative (surgical) technique for extracting impacted wisdom teeth. *But evidence does support temporary lingual nerve injury related to lingual access surgery 10% of which are permanent*

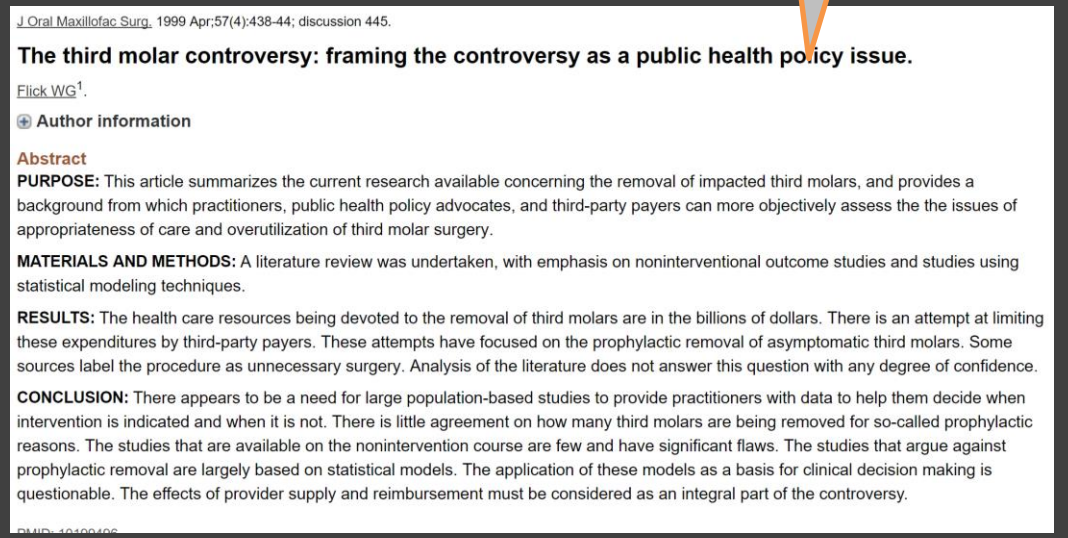
What is the Health benefit or cost benefit of M3M surgery?

- Ruta DA, Bissias E, Ogston S, Ogden GR. Assessing health outcomes after extraction of third mola[illegible]: the postoperative symptom severity (PoSSe) scale. Br J Oral Maxillofac Surg. 2000 Oct;38(5):480-7.
- Jay W. Friedman. The Prophylactic Extraction of Third Molars: A Public Health Hazard Am J Public Healt[illegible] September; 97(9): 1554–1559.
- Cunha-Cruz J, Rothen M, Spiekerman C, Drangsholt M, McClellan L, Huang GJ. Northwest Practice-B[illegible] Research Collaborative in Evidence-Based Dentistry. Recommendations for third molar removal: a pr[illegible] cohort study. Am J Public Health. 2014;104(4):735-43.
- Lee CT, Zhang S, Leung YY, Li SK, Tsang CC, Chu CH. Patients' satisfaction and prevalence of complications [illegible] surgical extraction of third molar. Patient Prefer Adherence. 2015 Feb 10;9:257-63

Low evidence level for cost and health benefit
4 Prospective cohort trials

Edwards MJ, Brickley MR, Goodey RD, Shepherd JP. The cost, effectiveness and cost effectiveness of removal and retention of asymptomatic, disease free third molars.
Br Dent J. 1999 Oct 9;187(7):380-4.

CoFernandes MJ, Ogden GR, Pitts NB, Ogston SA, Ruta DA. Actuarial life-table analysis of lower impacted wisdom teeth in general dental practice. Community Dent Oral Epidemiol. 2010 Feb;38(1):58-67



J Oral Maxillofac Surg. 1999 Apr;57(4):438-44; discussion 445.

The third molar controversy: framing the controversy as a public health policy issue.

Flick WG[1].

Author information

Abstract

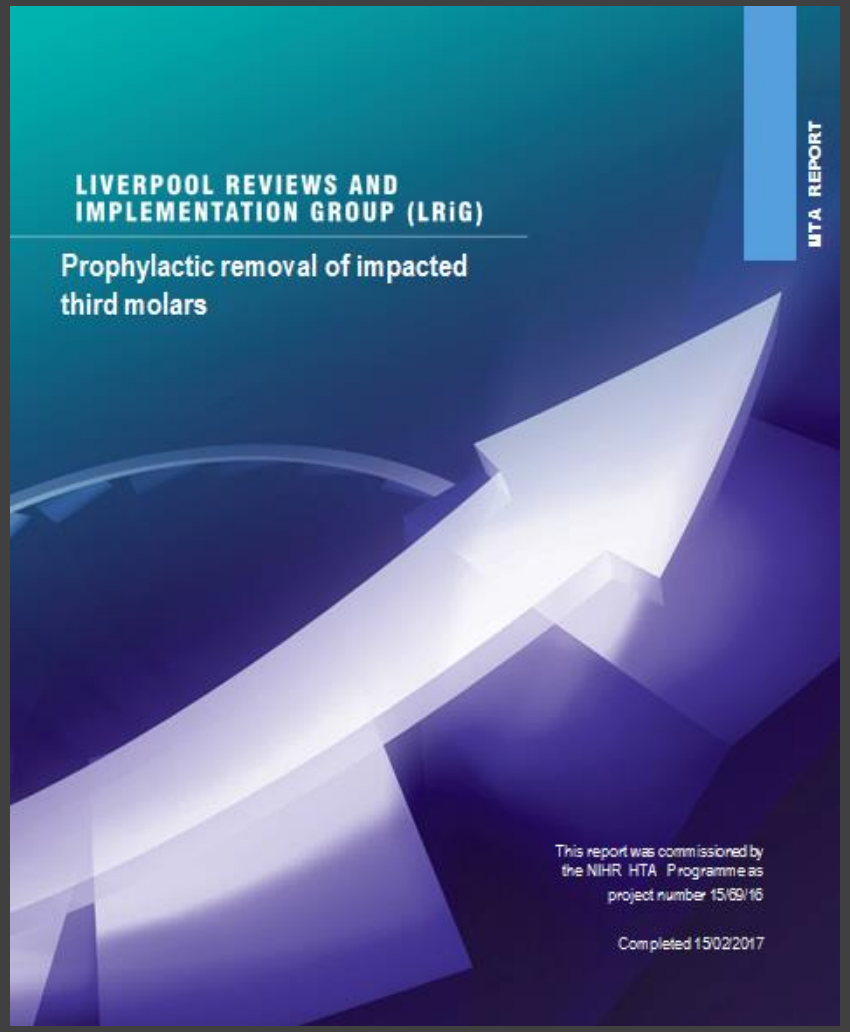
PURPOSE: This article summarizes the current research available concerning the removal of impacted third molars, and provides a background from which practitioners, public health policy advocates, and third-party payers can more objectively assess the the issues of appropriateness of care and overutilization of third molar surgery.

MATERIALS AND METHODS: A literature review was undertaken, with emphasis on noninterventional outcome studies and studies using statistical modeling techniques.

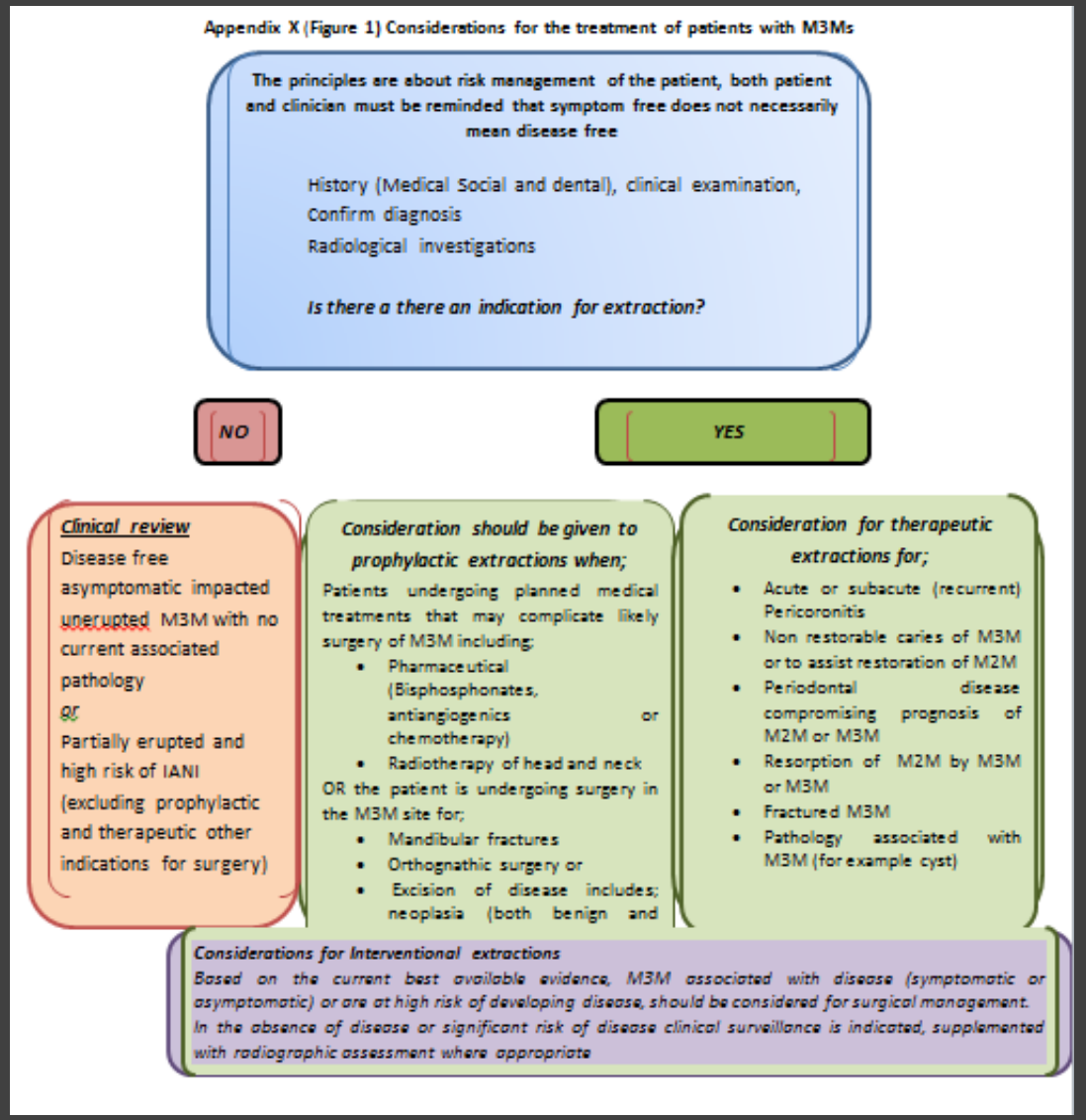
RESULTS: The health care resources being devoted to the removal of third molars are in the billions of dollars. There is an attempt at limiting these expenditures by third-party payers. These attempts have focused on the prophylactic removal of asymptomatic third molars. Some sources label the procedure as unnecessary surgery. Analysis of the literature does not answer this question with any degree of confidence.

CONCLUSION: There appears to be a need for large population-based studies to provide practitioners with data to help them decide when intervention is indicated and when it is not. There is little agreement on how many third molars are being removed for so-called prophylactic reasons. The studies that are available on the nonintervention course are few and have significant flaws. The studies that argue against prophylactic removal are largely based on statistical models. The application of these models as a basis for clinical decision making is questionable. The effects of provider supply and reimbursement must be considered as an integral part of the controversy.

NICE update Draft 2017
Coming soon



FDS RCS 2017
Coming soon



Only 3 of 21 Guidelines mention risk assessment

- Only 3/21 guidelines included coronectomy

BMJ Evidence M3M Dodson 2014
Cochrane Coulthard et al 2012
Swedish HTA 2011

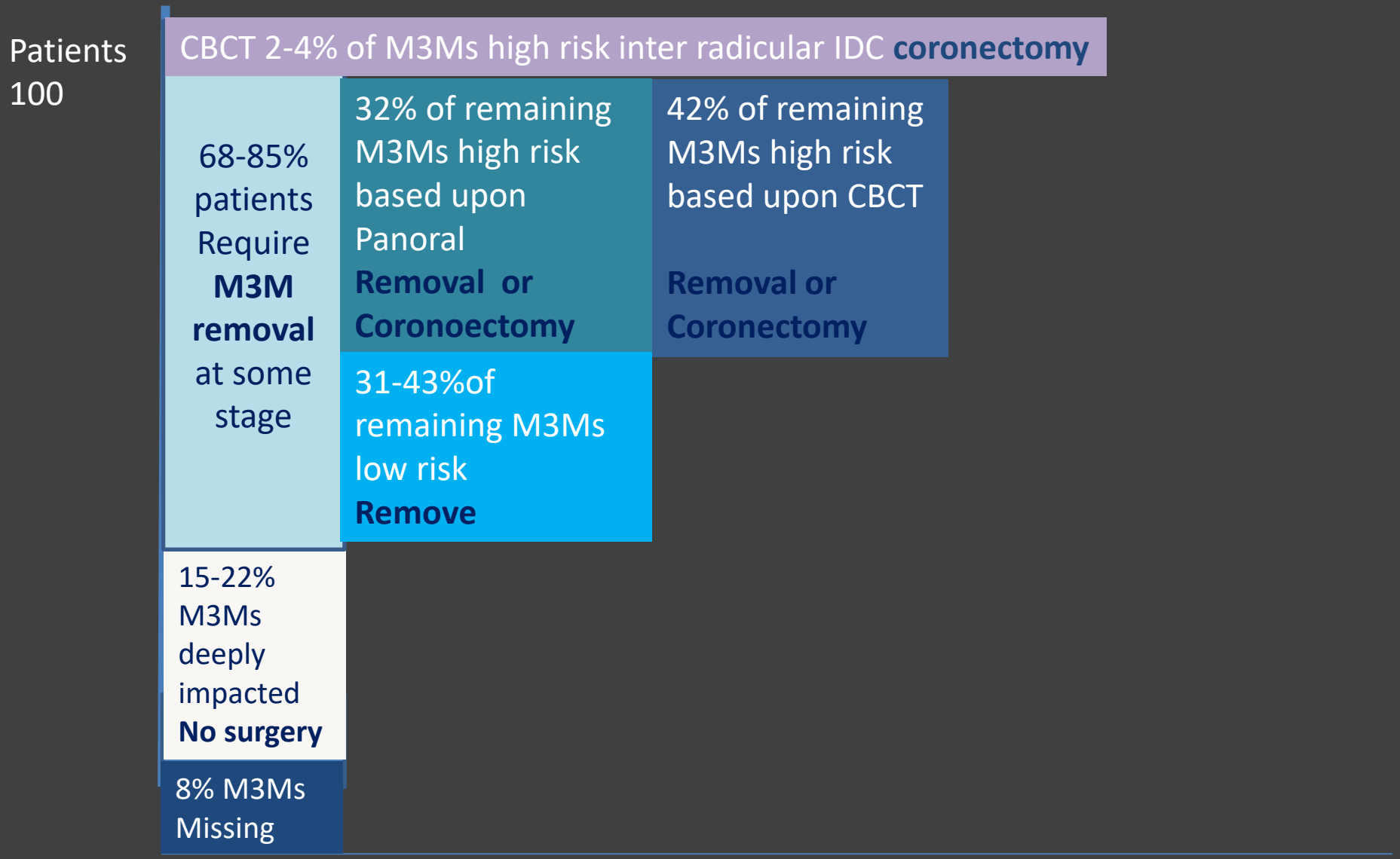
Table 2. Risk of bias assessment of the RCTs and quasi-experimental studies with the recommended approach of the Cochrane colaboration.

	TYPE OF STUDY	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Renton *et al.* (9) (2005)	RCT	+	−	−	−	+	+
Leung and Cheung (10) (2009)	RCT	+	+	+	+	+	?
Hatano *et al.* (14) (2009)	CCT	−	−	−	?	+	+
Cilasum *et al.* (8) (2011)	CCT	−	−	−	+	+	?

Medium evidence level
4 Prospective randomised trials

Cervera-Espert J, Pérez-Martínez S Cervera-Ballester J, Peñarrocha-Oltra D, Peñarrocha-Diago M. **Coronectomy of impacted mandibular third molars: A meta-analysis and systematic review of the literature.** Med Oral Patol Oral Cir Bucal. 2016 Jul 1;21(4):e505-13.

Should this be the Fate of M3Ms?



Overview

- Indications for surgery
- Timing of intervention
- Risk Assessment
  - Patient expectations and consent
  - Assessment
    - Patient factors
      - Medical
      - Social
      - Psychological
    - Difficulty and risk of surgery
    - Surgical technique
    - When is a coronectomy needed?
- Surgical technique & follow up

Complications of third molar surgery

- Intra-operative
- Early post-operative
- Late post-operative

- Surgically related
- Patient related
- Medically related
- Anaesthetic related

Patient died in her bed hours after 'routine' teeth extraction at dental practice

By DAILY MAIL REPORTER
UPDATED: 02:50, 24 April 2009

Share

View comments

A mother bled to death after having three teeth taken out in a routine dental extraction, an inquest heard today.

Pauline Coles, 38, died in bed after spitting up blood for several hours following local anaesthetic surgery at Blenheim House Dental Practice in Minehead, Somerset.

An inquest into her death at West Somerset Coroners' Court in Exmoor heard that Ms Coles' blood would not clot because she had severe cirrhosis of the liver.

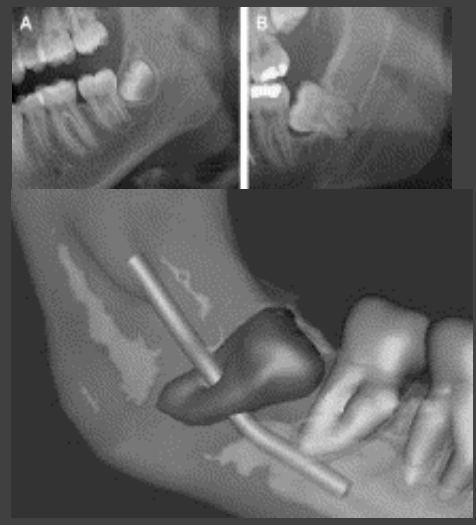
Ms Coles, an alcoholic, would not seek medical help for her health problems or the constant bleeding because she was frightened of hospitals.

She was found to have twice the legal drink drive limit of alcohol in her blood when she died at her home in Conifer Close, Exford, at around 12.30am on July 18 last year.

Risk assessment

There is an element of risk inherent in all clinical decisions
Both the patient and the clinician should be fully aware of them

- Patient's expectations ….Are they managed?
  - Understand treatment options
  - Understand risk vs benefit
  - Understand costs
  - **All should be covered in consent process**
- Has the clinician anticipated the;
  - Medical risk?
  - Social risk ?
  - Psychological risk?
  - Surgical risk/ complications ?
  - Access to follow up and contact?



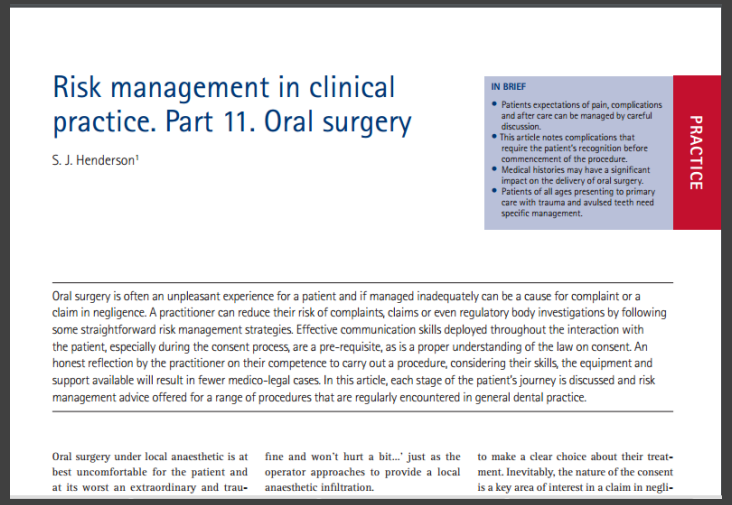
Easy tooth on a difficult patient
OR
A difficult tooth on an easy patient?

No evidence level

- **Clinical examination**
  - Extra Oral
    - TMD
    - Lymph nodes
    - Mouth opening
  - Intraoral
    - Mucosa pericoronitis/pathology
    - Condition of dentition
    - Oral hygiene
    - Adjacent tooth
  - **Is your diagnosis confirmed?**
  - **Likely need for tooth removal?**
  - **Radiographic assessment**
  - **Pathology –biopsy report needed**
  - **Additional medical interventions?**

Challenges to clinical decision making

- On a stranger
- How informed is valid consent?
- Montgomery ruling
- Patient responsible for their decision?



Risk management in clinical practice. Part 11. Oral surgery

S. J. Henderson[1]

PRACTICE

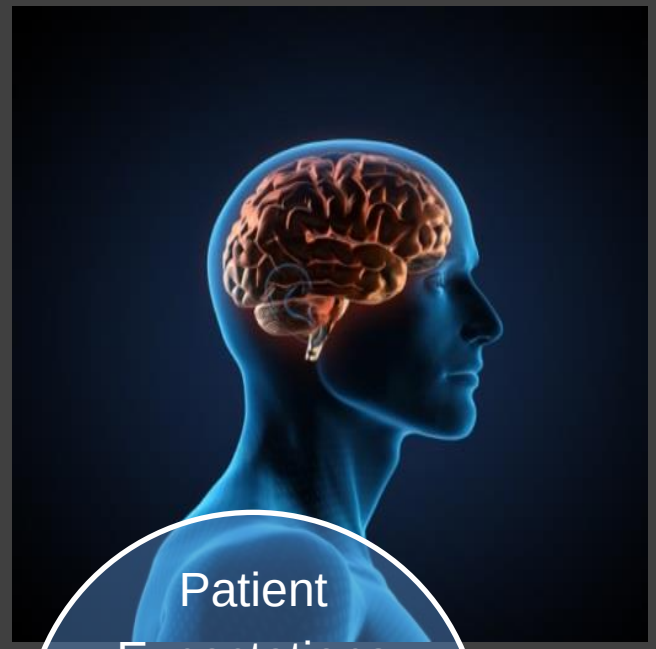
IN BRIEF

- Patients expectations of pain, complications and after care can be managed by careful discussion.
- This article notes complications that require the patient's recognition before commencement of the procedure.
- Medical histories may have a significant impact on the delivery of oral surgery.
- Patients of all ages presenting to primary care with trauma and avulsed teeth need specific management.

Oral surgery is often an unpleasant experience for a patient and if managed inadequately can be a cause for complaint or a claim in negligence. A practitioner can reduce their risk of complaints, claims or even regulatory body investigations by following some straightforward risk management strategies. Effective communication skills deployed throughout the interaction with the patient, especially during the consent process, are a pre-requisite, as is a proper understanding of the law on consent. An honest reflection by the practitioner on their competence to carry out a procedure, considering their skills, the equipment and support available will result in fewer medico-legal cases. In this article, each stage of the patient's journey is discussed and risk management advice offered for a range of procedures that are regularly encountered in general dental practice.

Oral surgery under local anaesthetic is at best uncomfortable for the patient and at its worst an extraordinary and traufine and won't hurt a bit...' just as the operator approaches to provide a local anaesthetic infiltration.

to make a clear choice about their treatment. Inevitably, the nature of the consent is a key area of interest in a claim in negli-



Patient assessment if in doubt…….
Ask the same questions as the lawyers

Taking a good history ensures medical issues avoided

- Was there a good indication to remove the tooth?
- Was the patient warned/ consented?
- Was there an elevated risk?
- Was additional assessment undertaken to assess heightened risk?
- Was the patient warned and further assessed with elevated risk?
- Was alternative treatment offered in light of elevated risk?
- Was the patient followed up in 24 hours?
- Was complication /nerve injury recognised?
- Was patient referred early for specialist care?

Consent for extraction for M3Ms

Common complications associated with any surgery:

- TMD temporary TMD arthromyalgia < 2 weeks in over 20% of patients
- Dry Socket 5%
- Rare
  - Nerve injury (unless high risk) 2% temporary and 0.2% permanent
  - Severe pain
  - Severe swelling
  - Excessive bleeding during or soon after the operation, requiring another operation to stop the bleeding.
  - Infection, requiring antibiotics to treat it.
  - Unexpected reaction to the anaesthetic.

- **Consent for Homecheck**
- Advice re oral hygiene
- Advice re analgesia
  - Ibuprofen 600mg + Paracetamol 1g combined
  - For adult patients 4 hourly first day 6 hourly other

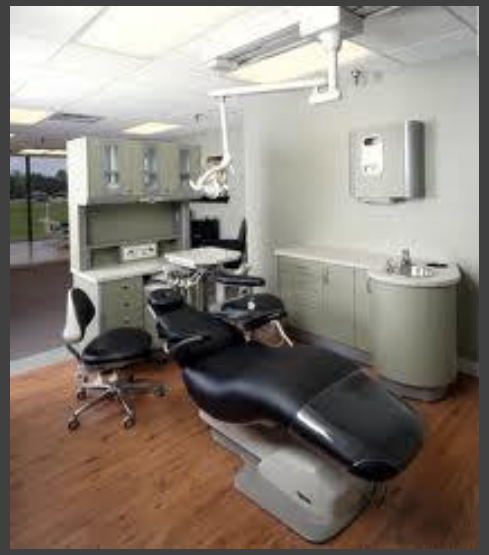
Sequelea to wisdom-teeth removal:

What to expect after tooth removal

- Pain or soreness for up to 48 hours
- Swelling worst for the first 2 days
- Sore throat
- Limited mouth opening and jaw joint pain or stiffness
- Bad breath from clot
- Sensitivity of teeth adjacent to socket
- Socket may still be a hole in the gum for up to 3 months

- http://www.rcseng.ac.uk/patient_information/get-well-soon/wisdom-teeth-extraction

Managing patients expectations of surgical related risks!



Relationship between preoperative expectations, satisfaction, and functional outcomes in patients undergoing lumbar and cervical spine surgery: a multicenter study. Soroceanu A, Ching A, Abdu W, McGuire K. Spine (Phila Pa 1976). 2012 Jan 15;37(2):E103-8

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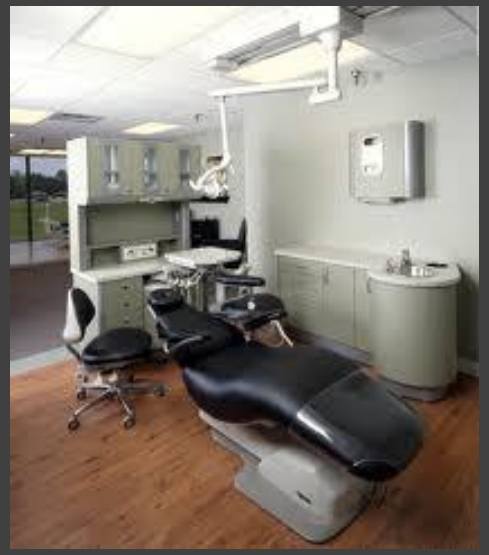

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Patients hear less than 15% of the conversation from the dental chair = the operating table!!!!!

Key to successful communication for consent is the **medical model**

Relationship between preoperative expectations, satisfaction, and functional outcomes in patients undergoing lumbar and cervical spine surgery: a multicenter study. Soroceanu A, Ching A, Abdu W, McGuire K. Spine (Phila Pa 1976). 2012 Jan 15;37(2):E103-8

Did you know?
Consenting higher risk patients

- **There is a case NHSLA admitted that in 2009 it was a breach of duty not to offer a patient with high risk M3M a coronectomy or alternative procedure**
- Then July 2014 Cochrane review stated that likely that coronectomies reduce the risk of IANI
- But since evidenced to support minimising harm to patients
  - Systematic review 2012 The authors stated that coronectomy could be used in clinical practice, for third molar extractions, with a high risk of nerve injury. The risks of failed coronectomy could be reduced by improving surgical procedures and by monitoring radiographic risk factors.
    - Long H, Zhou Y, Liao L, Pyakurel U, Wang Y, Lai W. Coronectomy vs total removal for third molar extraction: a systematic review. Journal of Dental Research 2012; 91(7): 659-665
  - Systematic review 2016 Coronectomy is indicated when the mandibular third molar is in contact with the inferior alveolar nerve and complete removal of the tooth may cause nerve damage.
    - Cervera-Espert J , Pérez-Martínez S, Cervera-Ballester J, Peñarrocha-Oltra D, Peñarrocha-Diago M. Coronectomy of impacted mandibular third molars: A meta-analysis and systematic review of the literature. Med Oral Patol Oral Cir Bucal. 2016 Jul 1;21(4):e505-13.

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Mandibular third molar surgery

Lingual and Inferior alveolar nerves (IAN) injuries

Risk factors MAINLY patient and surgical!!!!!!!

Lingual nerve

- Age of the patient
- Poor surgical technique
  - Junior surgeons
  - Duration of surgery
  - Lingual access surgery
  - Distal bone removal and lingual nerve injury
    - Use Buccal approach
    - Minimal access
  - ‘aberrant’ Lingual nerve anatomy
    - 11-18% of lingual nerve above alveolar crest distal to M3Ms

Inferior alveolar nerve

- Age of the patient
- Intra-operatory exposure of the nerve
- Un-erupted tooth
- Poor Radiographic risk assessment
  - Perforation of tooth roots by IDC
  - Proximity of tooth roots to inferior dental canal (IDC)
  - Plain film
    - IDC loss LD
    - Darkening of roots
    - Deviation of IDC
  - CBCT lack cortication, distortion of canal. Lingual IDC

Medium evidence lingual nerve

Low evidence inferior alveolar nerve

Acta Odontol Scand. 2013 Jul 4. The importance of a good evaluation in order to prevent oral nerve injuries: A review.Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J. 662 were obtained from the search, from which 25 were selected accomplishing the inclusion criteria. Moreover, seven important articles were selected from the references of the ones mentioned, obtaining a total of 32 articles for the review. Renton T, McGurk M. Brit J Oral Maxillofac Surg 2001; 39: 423-428 Acta Odontol Scand. 2013 Jul 4. [Epub ahead of print]
The importance of a good evaluation in order to prevent oral nerve injuries: A review.Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J. 662 were obtained from the search, from which 25 were selected accomplishing the inclusion criteria. Moreover, seven important articles were selected from the references of the ones mentioned, obtaining a total of 32 articles for the review.

Patient factors associated with higher M3M surgery morbidity?

- **All complications related to**

Age of the patient > 25 years

- Duration of surgery
- Intra-operatory exposure of the nerve
- Un-erupted tooth

- LNI
- Technique access for the lower third molar extraction
- the surgeon's inexperience.

- IANI
- The radiological examination is useful to evaluate the nerve damage and to decide on the surgical technique

Relevant studies have been identified and are reported for the following complications and their relationship to the patient's age:

- **time to recovery**
- **incidence of fractures**
- **rates of infection**
- **periodontal complications**
- **temporomandibular joint complications**
- **nerve injury**
- **sinus-related complications.**

Pogrel MA. What is the effect of timing of removal on the incidence severity of complications? J Oral Maxillofac Surg. 2012 Sep;70(9 S 1):S37-40. doi: 10.1016/j.joms.2012.04.028. Epub 2012 Jun 16.

High evidence level

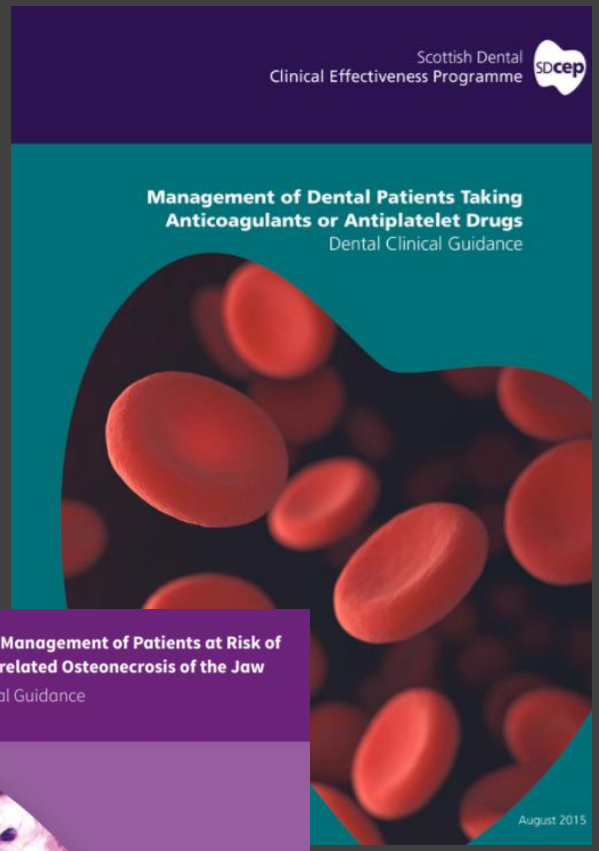
Acta Odontol Scand. 2013 Jul 4.The importance of a good evaluation in order to prevent oral nerve injuries: A review.Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J. 662 were obtained from the search, from which 25 were selected accomplishing the inclusion criteria. Moreover, seven important articles were selected from the references of the ones mentioned, obtaining a total of 32 articles for the review.

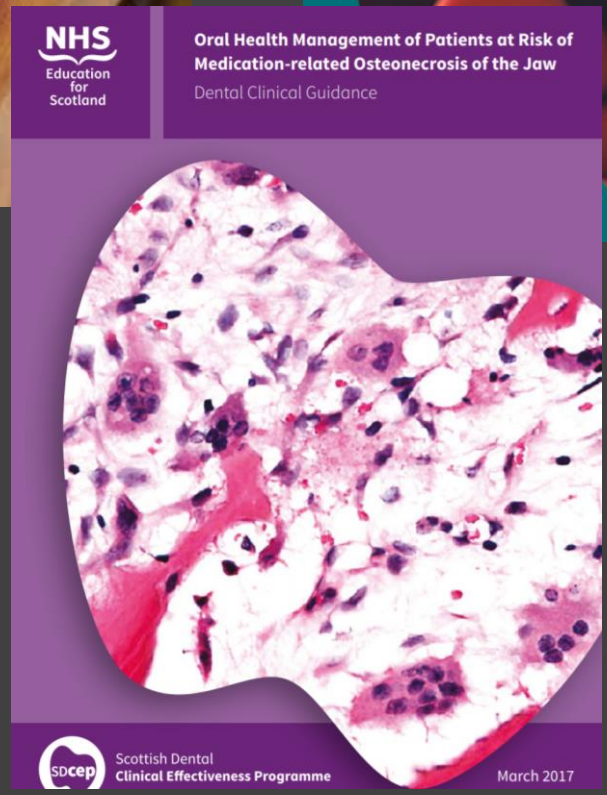
Patient factors that increase the risk of complications once a decision has been made to proceed to M3M surgery are:

1. **Presence/absence of underlying systemic disease that may interfere with normal healing** *(eg: diabetes mellitus, chronic renal disease, hepatic disease, haematological disorder, steroid therapy, contraceptive medication, immunosuppression, malnutrition)*
2. ***Age alone is not regarded as a significant risk factor in patients judged healthy by classification of the American Society of Anaesthesiology(ASA) but it is generally agreed that with an increase of age local complications of removal become more common and severe.***
3. Anatomical position of tooth *(eg: ectopic position with angulation/rotation leading to compromised access)*
4. Root morphology *(eg: dilaceration, divergence, size, shape, number)*
5. Local anatomical relationships *(eg: maxillary sinus/nasal cavity/lingual and inferior alveolar nerves/adjacent teeth)*
6. Status of adjacent teeth *(eg: periodontal disease/ presence of restoration/fractured crown/function as bridge abutment)*
7. Other conditions leading to limited access to oral cavity (*eg: trismus due to any cause including infection, muscular and neuromuscular disorders, constricted oral orifice)*
8. Patient cooperation/compliance *(eg: degree of patient and/or family understanding of the clinical problem, aims of and acceptance of proposed treatment).*
9. Bulk of supporting bone in maxilla/mandible
10. Increased or significantly diminished bone density
11. Ankylosis of tooth/teeth
12. Presence/absence of acute/chronic infection
13. Presence/absence of associated disease/ pathology *(eg: cysts/ neoplasia)*
14. Presence/absence of other local bone/soft tissue disease *(eg: Paget's Disease/vascular malformations/post-radiation vascular sclerosis)*

Patient comorbidity impacting on M3M care

- Local
  - Trismus
  - Spreading infection difficult LA
  - Heavily restored adjacent teeth
  - Dental factors increasing surgical difficulty
  - Associated pathology
- Systemic factors
  - Prolonged bleeding
    - Acquired Factor 10a inhibitors
    - Congenital
  - Immune suppression
  - Medications bisphosphonates
  - Previous radiotherapy
  - Anxiety need for sedation





Patients at risk of infection

Immuno-compromise

Antibiotics NOT indicated for routine extractions

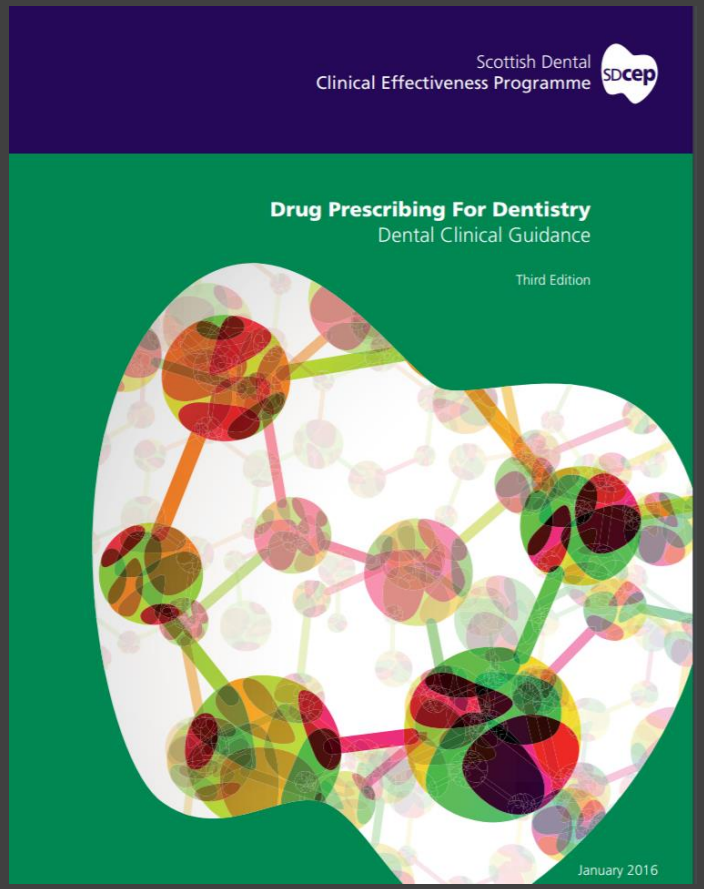
Immature immunity infants
Malnutrition older population

Disease

Diabetes Mellitis (type 1 and 2)
Alcoholism
Cirrhosis
Renal failure
Splenectomy
Malignant tumours
Leukaemia Lymphoma Myeloma
Collagen disease
HIV AIDS
Pagets

Medication

Steroids
Immunosuppressants / chemotherapy
organ transplant
Bisphosphonates
Radiation therapy



Adjunctive care – anxiety level - anaesthesia selection

Medications commonly utilized for M3M surgery

Local anaesthesia / sedation Algorithm for selection of appropriate anaesthesia and sedation

Analgesics?

Rarely

Antibiotics?

Steroids?

Chlorhexidine?

Other medicaments Section ?

Remember all treatment options do not suit all patients!

To extract or not extract? That is the question……

How to extract is the next question!!!

- Reassurance surveillance / clinical review
  - With diagnosis of different conditions causing symptoms and requiring management
  - Contraindications to Surgery?
- Restorative +/-restoration, endo
- Orthodontics +/- extractions
- Orthodontic extrusion
- Surgical exposure +/- ortho traction
- Coronectomy
- Surgical removal
- Transplant

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The need to prevent nerve injury related to M3M

Proximity to the IDC
Application depth
M3M Root morphology
Condition of adjacent M2M

Risk Factors for IANI related to TMS

- Patient age: It is well understood that older patients over the age of 25 years do not recover from nerve damage and are more likely to be affected by persistent IANI when the nerve is damaged during oral surgery.[12] The reasons for this might be that the healing ability decreases with an increasing age and that more bone is usually removed owing to completely formed roots or increased bone mineralization.[13] Blondeau and Daniel[14] recommended that prophylactic M3M extraction should be avoided in patients aged 24 years or older because of a high possibility of complications such as permanent neurosensory deficits, infection, and alveoli

- Gender: Females have been reported to be more at risk of persistent IANI.[15]

- Surgeon experience: The prevalence of IANI is also dependent on the surgeon experience and [illegible] used. In 2013, a study[16] reported that IANI developed in 3 of 71 (4.2%) teeth in patients treated by the surgeons with 1 - 4 years of experience, in 14 of 175 (8%) teeth in the group treated by surgeons with 5 - 9 years of experience, and 11 of 194 (5.7%) teeth in the group of patients treated by surgeons with more than 10 years of experience. The incidence of IANI after extraction by surgeons with 5 - 9 years of experience was the highest in the 3 groups. However, there was no significant difference in the incidence based on surgeon seniority ($P > 0.01$). In a more recent study, operator experience was also related to IANI risk ($P < 0.001$) Specialist 2.85% trainees 1.33% /UGs 0.2% IANI deficit.[17, 18]

Medium evidence level

Risk Local Factors for IANI

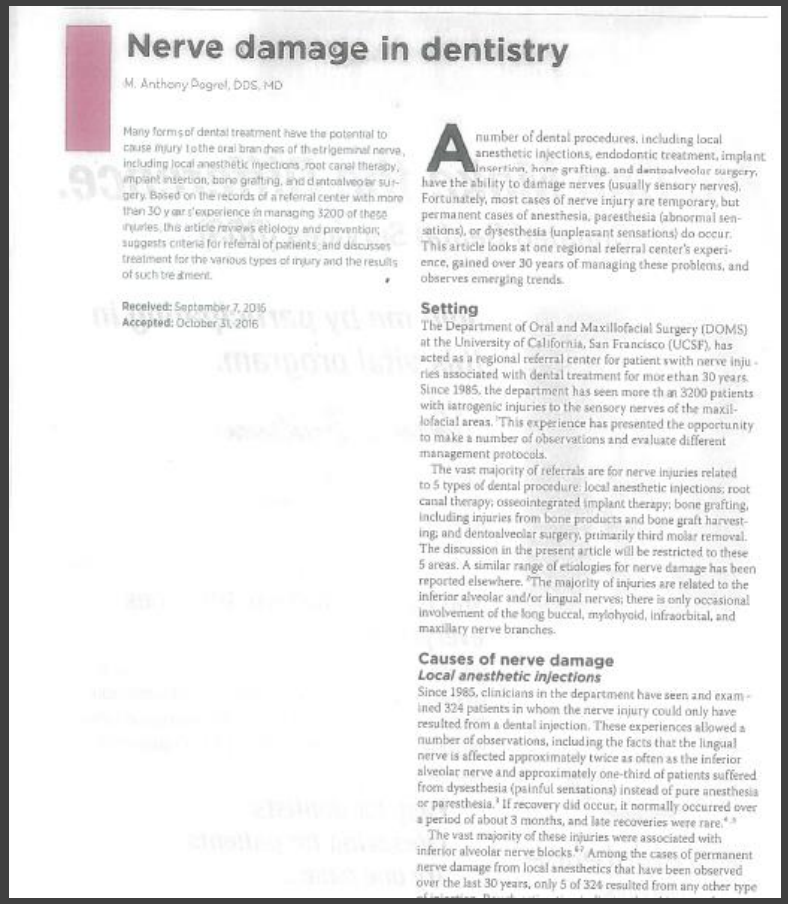
- Eruption status & Depth of impaction: A literature review of 32 prospective articles[18] highlighted that unerupted M3M status was the strongest indicator for IANI (Erupted 0.32% deficit: Partially erupted 0.67% deficit: unerupted 3% deficit). Depth of impaction and the pattern of impaction illustrated no statistical differences, however, this is likely due to the different systems used to describe impaction pattern and depth.

- Risk factor impaction In 2013, Smith[19] presented a clinical study on 1,000 patients, removing 1,589 impacted M3 teeth. Of the 1,589 M3 teeth extracted, 466 (29%) demonstrated a distant relationship of their apices to the MC, 869 (55%) were close to the canal, and only 254 (16%) were deemed to be intimate to the canal by radiographic evidences. Postoperatively, 39 patients (3.9%) reported neurosensory disturbance over the distribution of the IAN nerve in 40 extractions. Seven patients (0.7%) sustained permanent sensory loss. The incidence of IAN neurosens[illegible] defici[illegible]vas highest with horizontal impaction (4.7%) and lowest when the teeth were vertically impacted (0.9%). Ho[illegible] difference between each type of impaction is not statistically significant ($P > 0.01$).

- Intra-operative nerve exposure and bleeding during surgery: It has been reported that exposure [illegible] factor for IANI.[11] Inferior dental bleed during surgery is also reported to be associated with increased IANI[illegible]

Medium evidence level

Nerve damage related to dental procedures are rare but have a significant impact on the patients involved



Nerve damage in dentistry

M. Anthony Pogrel, DDS, MD

Many forms of dental treatment have the potential to cause injury to the oral branches of the trigeminal nerve, including local anesthetic injections, root canal therapy, implant insertion, bone grafting, and dentoalveolar surgery. Based on the records of a referral center with more than 30 years' experience in managing 3200 of these injuries, this article reviews etiology and prevention; suggests criteria for referral of patients; and discusses treatment for the various types of injury and the results of such treatment.

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Accepted: October 31, 2016

A number of dental procedures, including local anesthetic injections, endodontic treatment, implant insertion, bone grafting, and dentoalveolar surgery, have the ability to damage nerves (usually sensory nerves). Fortunately, most cases of nerve injury are temporary, but permanent cases of anesthesia, paresthesia (abnormal sensations), or dysesthesia (unpleasant sensations) do occur. This article looks at one regional referral center's experience, gained over 30 years of managing these problems, and observes emerging trends.

Setting

The Department of Oral and Maxillofacial Surgery (DOMS) at the University of California, San Francisco (UCSF), has acted as a regional referral center for patient swith nerve injuries associated with dental treatment for mor ethan 30 years. Since 1985, the department has seen more th an 3200 patients with iatrogenic injuries to the sensory nerves of the maxillofacial areas.[1] This experience has presented the opportunity to make a number of observations and evaluate different management protocols.

The vast majority of referrals are for nerve injuries related to 5 types of dental procedure: local anesthetic injections; root canal therapy; osseointegrated implant therapy; bone grafting, including injuries from bone products and bone graft harvesting; and dentoalveolar surgery, primarily third molar removal. The discussion in the present article will be restricted to these 5 areas. A similar range of etiologies for nerve damage has been reported elsewhere.[2] The majority of injuries are related to the inferior alveolar and/or lingual nerves; there is only occasional involvement of the long buccal, mylohyoid, infraorbital, and maxillary nerve branches.

Causes of nerve damage

Local anesthetic injections

Since 1985, clinicians in the department have seen and examined 324 patients in whom the nerve injury could only have resulted from a dental injection. These experiences allowed a number of observations, including the facts that the lingual nerve is affected approximately twice as often as the inferior alveolar nerve and approximately one-third of patients suffered from dysesthesia (painful sensations) instead of pure anesthesia or paresthesia.[3] If recovery did occur, it normally occurred over a period of about 3 months, and late recoveries were rare.[4,5]

The vast majority of these injuries were associated with inferior alveolar nerve blocks.[6,7] Among the cases of permanent nerve damage from local anesthetics that have been observed over the last 30 years, only 5 of 324 resulted from any other type

Pogrel MA. Nerve damage in dentistry. Gen Dent. 2017 Mar-Apr;65(2):34-41

Prognosis of nerve injuries

Nerve damage related to dental procedures are mainly permanent

(except LA and LNIs related to lingual access M3M surgery)

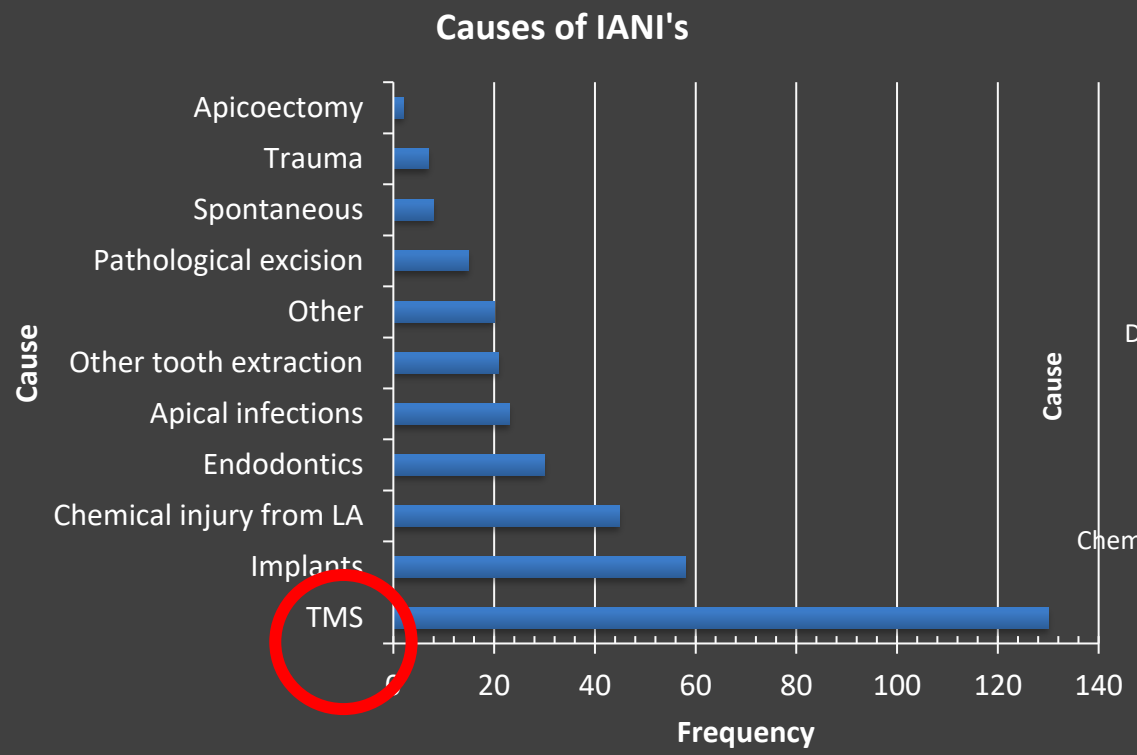
Permanency of NIs

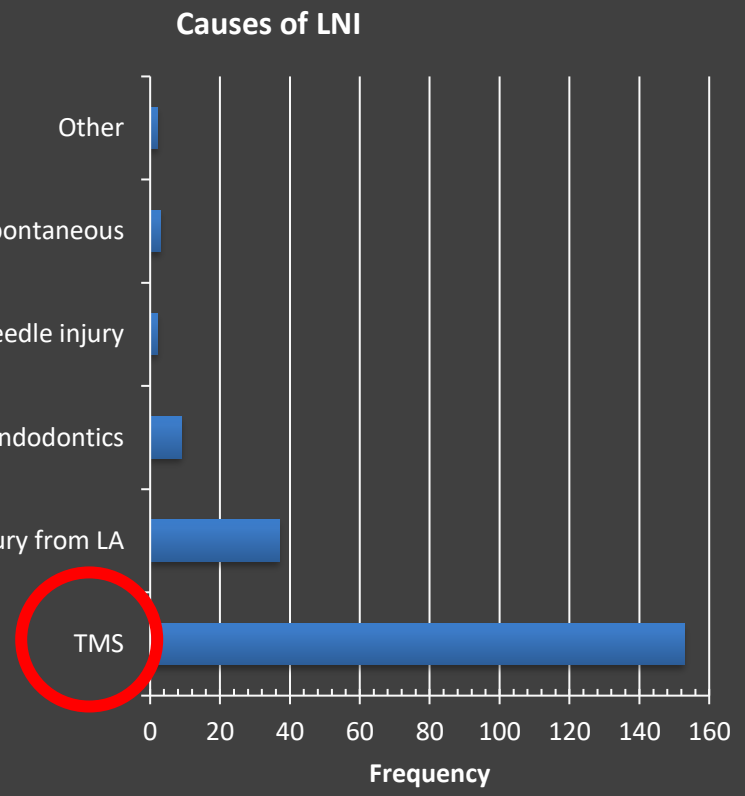
- TMS IANI 0.01-2%
- TMS lingual access LNI 10-12%
- LA IDB 25%
- Implant 60-87%
- Endo 86-87%

PROCEDURE	RECOVERY RATE	REFERENCE
Third molar surgery	Buccal access TMS Permanent and temporary IANI – 67%; LNI – 72% Permanent IANI Overall High risk 98% Low risk 99.8% LNI – lingual access TMS 90% & 88%	(Cheung et al., 2010) (Rud 1983, Renton et al 2005) (Mason, 1988) (Blackburn, 1990)
Mandibular fractures	IANI 91%	(Bede, Ismael, Al-Assaf, & Omer, 2012)
Orthognathic surgery	IANI 97% BSSO IANI (patients are quoted 8-20%)	(Iannetti, Fadda, Riccardi, Mitro, & Filiaci, 2013)
Local anaesthesia Inferior dental block (Lidocaine)	75%	(T Renton & Devine, 2013)
Implant-related IANI	Complete recovery 50% Partial recovery 44% No change 6% Complete 3% Partial lot 13% some 23% None 61%	(Juodzbalys, et al Galindo-Moreno, 2013) (Renton et al 2016 in press)
Endodontics	Survey 2338 patients 7% sustained chronic NePain 61 patients post endo overfill recovery 13% 8 asymptomatic, 42 only mild symptoms (<3 months injuries) 10 partial resolution 11 symptomatic + surgical exploration. 14% (24/28 of patients experienced no)	(Klasser et al 2011) (Pogrel et al 2007) (Renton et al 2016 in press)

When do nerve injuries related to dentistry happen?

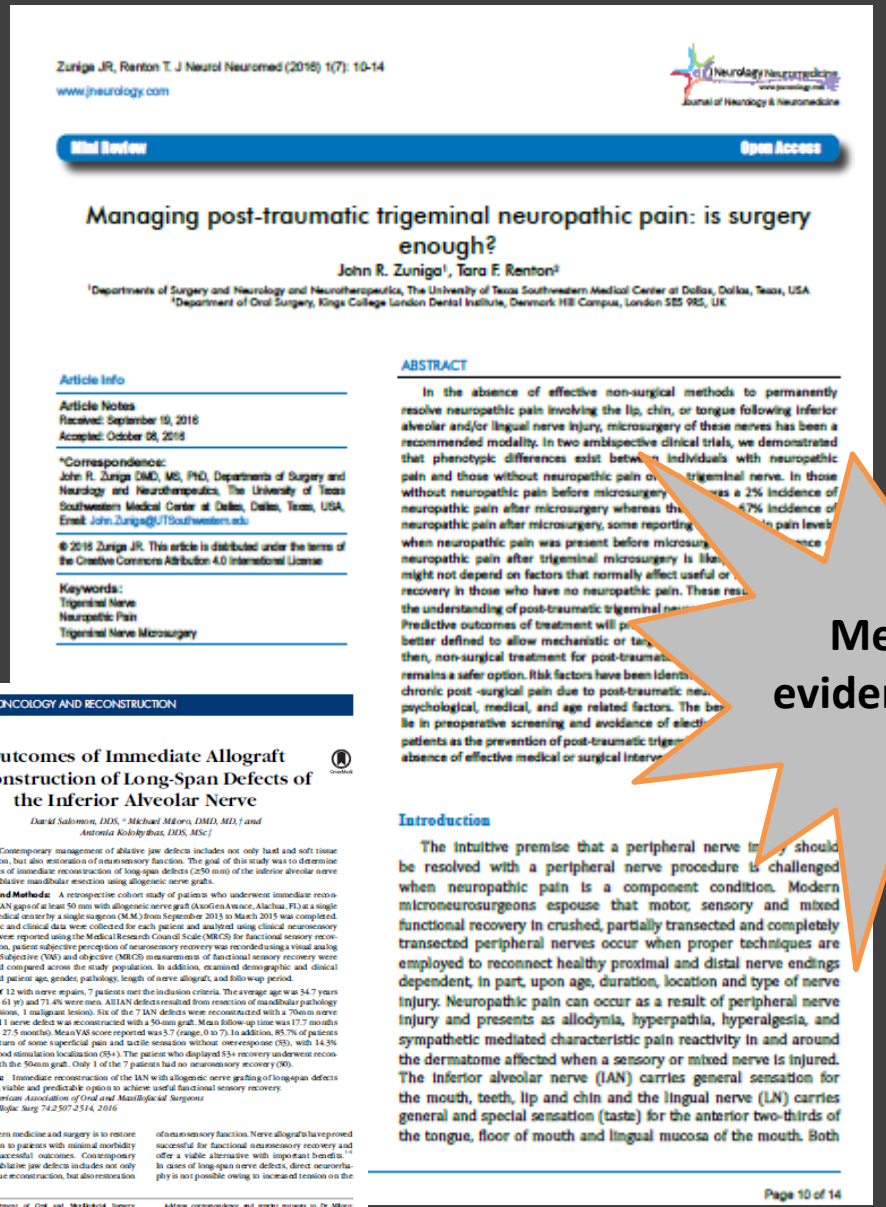
- **Summary of nerve injury patients** March 2008 –2016
- 400 IANI patients (73% F: 26.8% M; mean age = 46.5 years [range 18 – 85])
- 214 LNI patients (64.5% F: 34.6% M; mean age = 38.6 years [range 20 -73])





AND……We cant fix them!

- Neuropathic pain does NOT respond to surgery
- Direct re anastimosis of excised IAN injury requires grafting
- Most successful cadaver treated Allograft nerve tissue ONLY applicable in USA



Zuniga JR, Renton T. J Neurol Neuromed (2016) 1(7): 10-14
www.jneurology.com

Mini Review Open Access

Managing post-traumatic trigeminal neuropathic pain: is surgery enough?

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Keywords:
Trigeminal Nerve
Neuropathic Pain
Trigeminal Nerve Microsurgery

ABSTRACT

In the absence of effective non-surgical methods to permanently resolve neuropathic pain involving the lip, chin, or tongue following inferior alveolar and/or lingual nerve injury, microsurgery of these nerves has been a recommended modality. In two ambispective clinical trials, we demonstrated that phenotypic differences exist betwe[illegible] individuals with neuropathic pain and those without neuropathic pain o[illegible] trigeminal nerve. In those without neuropathic pain before microsurgery [illegible]as a 2% incidence of neuropathic pain after microsurgery whereas th[illegible] 47% incidence of neuropathic pain after microsurgery, some reporting [illegible] pain levels when neuropathic pain was present before microsur[illegible]nce neuropathic pain after trigeminal microsurgery is lik[illegible] might not depend on factors that normally affect useful or[illegible] recovery in those who have no neuropathic pain. These res[illegible] the understanding of post-traumatic trigeminal ne[illegible] Predictive outcomes of treatment will p[illegible] better defined to allow mechanistic or ta[illegible] then, non-surgical treatment for post-traumat[illegible] remains a safer option. Risk factors have been identi[illegible] chronic post -surgical pain due to post-traumatic neu[illegible] psychological, medical, and age related factors. The be[illegible] lie in preoperative screening and avoidance of electi[illegible] patients as the prevention of post-traumatic trigem[illegible] absence of effective medical or surgical interve[illegible]

Introduction

The intuitive premise that a peripheral nerve i[illegible] should be resolved with a peripheral nerve procedure is challenged when neuropathic pain is a component condition. Modern microneurosurgeons espouse that motor, sensory and mixed functional recovery in crushed, partially transected and completely transected peripheral nerves occur when proper techniques are employed to reconnect healthy proximal and distal nerve endings dependent, in part, upon age, duration, location and type of nerve injury. Neuropathic pain can occur as a result of peripheral nerve injury and presents as allodynia, hyperpathia, hyperalgesia, and sympathetic mediated characteristic pain reactivity in and around the dermatome affected when a sensory or mixed nerve is injured. The inferior alveolar nerve (IAN) carries general sensation for the mouth, teeth, lip and chin and the lingual nerve (LN) carries general and special sensation (taste) for the anterior two-thirds of the tongue, floor of mouth and lingual mucosa of the mouth. Both

Page 10 of 14

SURGICAL ONCOLOGY AND RECONSTRUCTION

Outcomes of Immediate Allograft Reconstruction of Long-Span Defects of the Inferior Alveolar Nerve

David Salomon, DDS, * Michael Miloro, DMD, MD, † and Antonia Kolokythas, DDS, MSc†

Purpose: Contemporary management of ablative jaw defects includes not only hard and soft tissue reconstruction, but also restoration of neurosensory function. The goal of this study was to determine the outcomes of immediate reconstruction of long-span defects (≥50 mm) of the inferior alveolar nerve (IAN) after ablative mandibular resection using allogeneic nerve grafts.

Materials and Methods: A retrospective cohort study of patients who underwent immediate reconstruction of IAN gaps of at least 50 mm with allogeneic nerve graft (AxoGen Avance, Alachua, FL) at a single academic medical center by a single surgeon (M.M.) from September 2013 to March 2015 was completed. Demographic and clinical data were collected for each patient and analyzed using clinical neurosensory testing and were reported using the Medical Research Council Scale (MRCS) for functional sensory recovery. In addition, patient subjective perception of neurosensory recovery was recorded using a visual analog scale (VAS). Subjective (VAS) and objective (MRCS) measurements of functional sensory recovery were recorded and compared across the study population. In addition, examined demographic and clinical data included patient age, gender, pathology, length of nerve allograft, and follow-up period.

Results: Of 12 with nerve repairs, 7 patients met the inclusion criteria. The average age was 34.7 years (range, 18 to 61 yr) and 71.4% were men. All IAN defects resulted from resection of mandibular pathology (6 benign lesions, 1 malignant lesion). Six of the 7 IAN defects were reconstructed with a 70-mm nerve allograft, and 1 nerve defect was reconstructed with a 50-mm graft. Mean follow-up time was 17.7 months (range, 10 to 27.5 months). Mean VAS score reported was 3.7 (range, 0 to 7). In addition, 85.7% of patients displayed return of some superficial pain and tactile sensation without overresponse (S3), with 14.3% displaying good stimulation localization (S3+). The patient who displayed S3+ recovery underwent reconstruction with the 50-mm graft. Only 1 of the 7 patients had no neurosensory recovery (S0).

Conclusions: Immediate reconstruction of the IAN with allogeneic nerve grafting of long-span defects (≥5 cm) is a viable and predictable option to achieve useful functional sensory recovery.

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J Oral Maxillofac Surg 74:2507-2514, 2016

The goal of modern medicine and surgery is to restore form and function to patients with minimal morbidity and maximal successful outcomes. Contemporary management of ablative jaw defects includes not only hard and soft tissue reconstruction, but also restoration of neurosensory function. Nerve allografts have proved successful for functional neurosensory recovery and offer a viable alternative with important benefits.[1] In cases of long-span nerve defects, direct neurorrhaphy is not possible owing to increased tension on the

Medium evidence level

Cochrane Database of Systematic Reviews

Interventions for iatrogenic inferior alveolar and lingual nerve injury

Review | Intervention

Paul Coulthard, Evgeny Kushnerev, Julian M Yates, Tanya Walsh, Neil Patel, Edmund Bailey, Tara F Renton

First published: 16 April 2014

Editorial Group: Cochrane Oral Health Group

DOI: 10.1002/14651858.CD005293.pub2 View/save

Cited by (CrossRef): 0 articles Check for updates

Am score 28

2014

Abstract

Background

Iatrogenic injury of the inferior alveolar o
maxillofacial surgery procedures. Injury t
trigeminal nerve may result in altered ser
both and may include anaesthesia, parae
and hyperaesthesia. Injury to the lingual

- **Main results**
- Two studies assessed as at high risk of bias, reporting data from 26 analysed participants were included in this review. The age range of participants was from 17 to 55 years. Both trials investigated the effectiveness of low-level laser treatment compared to placebo laser therapy on inferior alveolar sensory deficit as a result of iatrogenic injury.
- Patient-reported altered sensation was partially reported in one study and fully reported in another. Following treatment with laser therapy, there was some evidence of an improvement in the subjective assessment of neurosensory deficit in the lip and chin areas compared to placebo, though the estimates were imprecise: a difference in mean change in neurosensory deficit of the chin of 8.40 cm (95% confidence interval (CI) 3.67 to 13.13) and a difference in mean change in neurosensory deficit of the lip of 21.79 cm (95% CI 5.29 to 38.29). The overall quality of the evidence for this outcome was very low; the outcome data were fully reported in one small study of 13 patients, with differential drop-out in the control group, and patients suffered only partial loss of sensation. No studies reported on the effects of the intervention on the remaining primary outcomes of pain, difficulty eating or speaking or taste. No studies reported on quality of life or adverse events.
- The overall quality of the evidence was very low as a result of limitations in the conduct and reporting of the studies, indirectness of the evidence and the imprecision of the results.
- Authors' conclusions
- There is clearly a need for randomised controlled clinical trials to investigate the effectiveness of surgical, medical and psychological interventions for iatrogenic inferior alveolar and lingual nerve injuries. Primary outcomes of this research should include: patient-focused morbidity measures including altered sensation and pain, pain, quantitative sensory testing and the effects of delayed treatment.

Prevention of M3M related nerve injury

What is the incidence of M3M related permanent inferior alveolar nerve injuries?

We do not know!

0.35 - 8.4%?

Risk factors

The injury of the inferior alveolar nerve can be predicted by various radiological signs.

Patients over the age of 24 years old

Horizontal impactions

Extraction by trainee surgeons

What we do know

The incidence of M3M related nerve injuries is rare but have a devastating impact on the patients involved

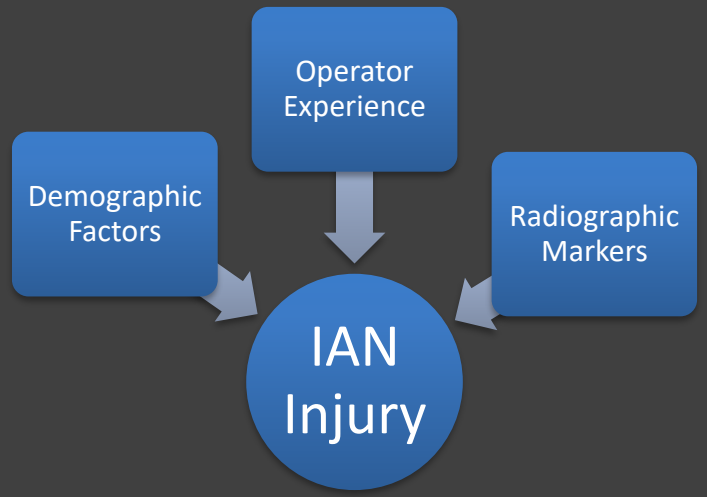
Is there elevated risk of nerve IAN injury?

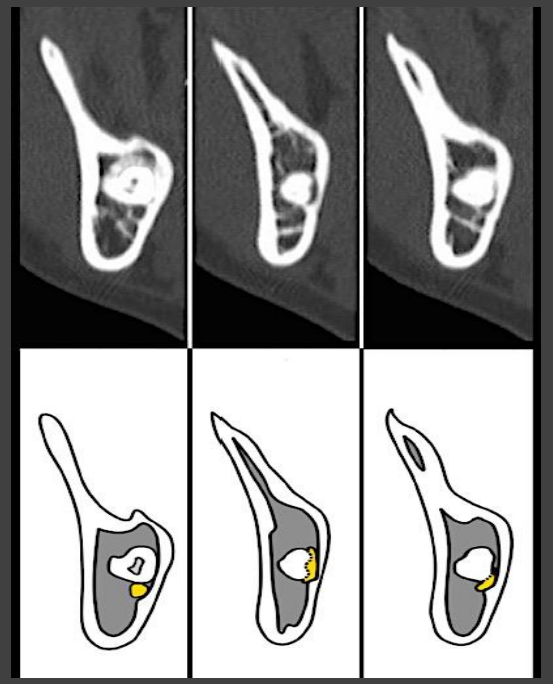
Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J The importance of a good evaluation in order to prevent oral nerve injuries: A review. Acta Odontol Scand.2013 Jul 4.

Factors that are associated with injury to the IAN in high-risk patients after removal of third Molars. Selvi, Dodson, Nattestad, Robertson, Tolstunov. BJOMS 51 (2013) 868–873. with permission.

Risk factors associated with IAN injury

- **Age of the patient**
- **Intra-operatory exposition of the nerve**
- **Surgeon's inexperience**
- **Radiographic markers:**
  - Plain film
  - CT





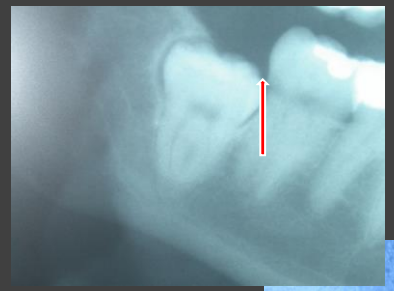
Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J The importance of a good evaluation in order to prevent oral nerve injuries: A review. Acta Odontol Scand.2013 Jul 4.

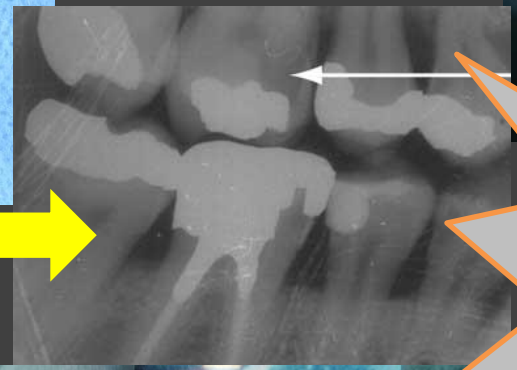
Factors that are associated with injury to the IAN in high-risk patients after removal of third Molars. Selvi, Dodson, Nattestad, Robertson, Tolstunov. BJOMS 51 (2013) 868–873. with permission.

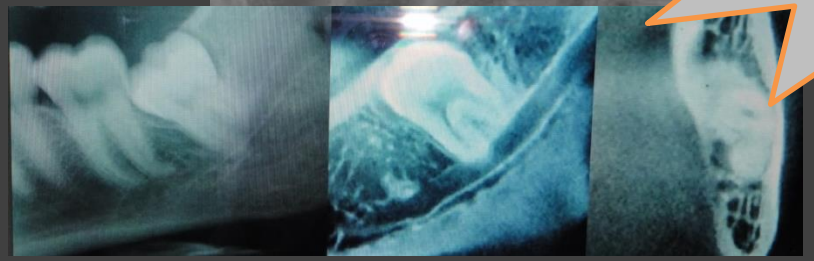
Increased surgical time - The assessment of local factors

Local factors influencing surgical difficulty of M3Ms

A. **Application point depth**.
    A. How this is measured?
B. Diagrammatic summary of tooth angulation
C. Crown width
D. Crown condition of 8 caries gross caries heavily restored
E Root width **(ADJ narrower than root splay?)**
F **Root morphology**
G Root surface area compared with adjacent tooth
H Enlarged follicular size
I. Associated Cyst
J Periodontal status 8 and 7
K **Restorative condition of adjacent 7**
L Long rooted lower M3MM3Ms or atrophic mandible
M **The relationship or proximity of upper M3MM3Ms to the maxillary antrum and of lower M3MM3Ms to the inferior dental canal**.







No evidence level

Increased surgical time - The assessment of local factors

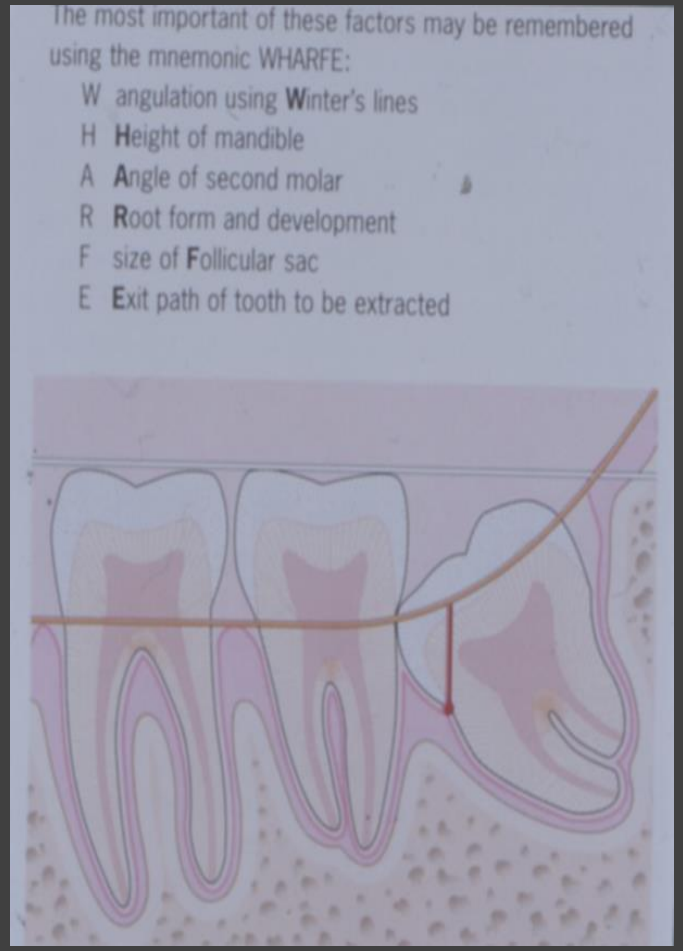
Assessment of difficulty

Should be carried out with the aim of assessing the status of the tooth itself and surrounding tissues . Several authors have attempted to grade the difficulty of M3M surgery these include;

- **Pell and Gregory Classification**
- **Winters Lines**
- **Pederson method of assessment of difficulty**
- **Yuasa classification of difficulty**
- **Renton and McGurk 2001**

The author believes that the most important factors are;

- **Patients factors (cooperation, age, ethnicity and mouth opening)**
- **Dental Factors (application depth, root morphology and condition of teeth and adjacent teeth)**
- **Surgical factors (surgeon technique and training)** However these suggested methods for difficulty assessment may assist the less experienced surgeon.



Renton T, McGurk M. Brit J Oral Maxillofac Surg 2001; 39: 423-428.

Increased surgical time - The assessment of local factors

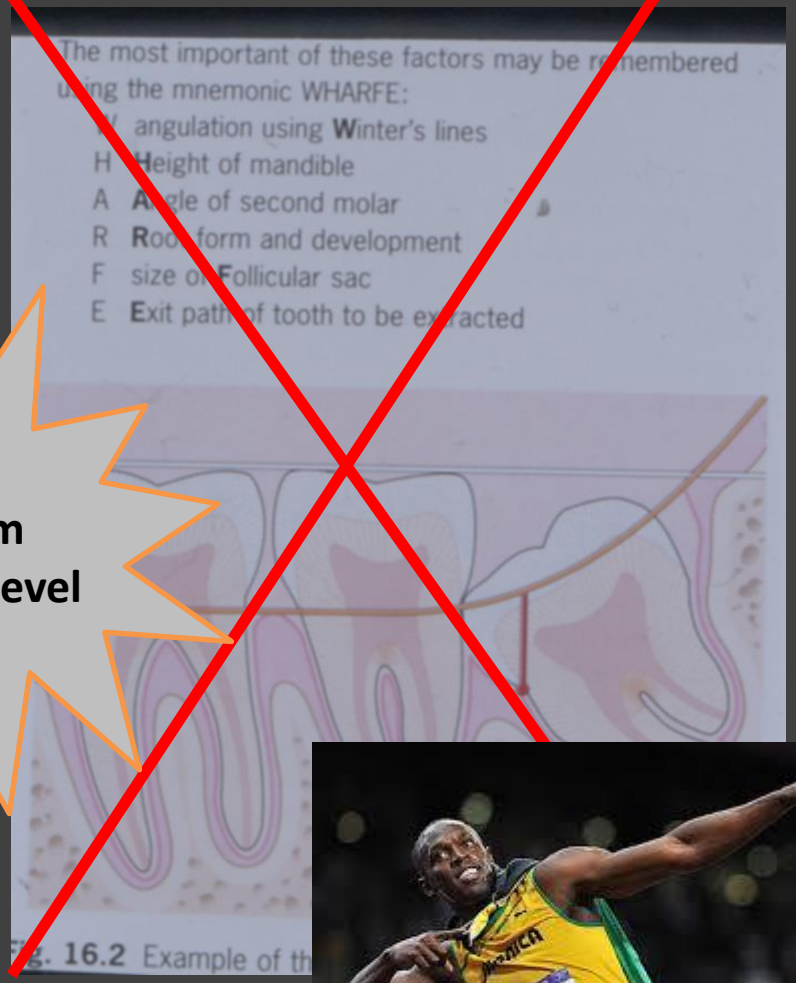
Risk Assessment of M3M

- ~~Winters lines 1960~~
- ~~Wharfe 1980~~
- ~~Pell & Gregory 1934~~

Renton & McGurk 2001

- **Age >27 years**
- **ethnicity**
- **weight**
- **depth of impaction**
- **Adjacent tooth condition**
- **Proximity to IAN**

Medium evidence level



Renton T, McGurk M. Brit J Oral Maxillofac Surg 2001; 39: 423-428.

The assessment of M3Ms

Clinical
MH DH SH
Indications for surgery
Access Limited opening
Patient compliance

Radiography The panoral is the mainstay radiograph used to assess M3Ms as intraoral films are often too uncomfortable to place appropriately. If the tooth is crossing the ID canal on the plain film and the tooth requires extraction then a CBCT may be indicated to exactly define the relationship between the M3M and ID canal containing the inferior alveolar nerve (see high risk M3M later in this section).

M3M Radiographic guidelines

In accordance with the ***"as-low-as-reasonably achievable" (ALARA) principle****, radiation dose for dental patients should be optimized to achieve the lowest practical level to address a specific clinical situation.*

Panoral for new patients & M3 assessment

- **European guidelines on radiation protection in dental radiology.** *The safe use of radiographs in dental practice*
- **The new FGDP(UK) guidelines** 2013 two previous editions, the format of the new FGDP(UK) *Selection Criteria for Dental Radiography*
- **Clinical justification of dental radiology in adult patients: A review of the literature Yolanda Martínez Beneyto , Miguel Alcaráz Baños , Leonor Pérez Lajarín , Vivian E. Rushton** Med Oral Patol Oral Cir Bucal 2007;12:E244-51.

CBCT

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Criteria needed for consensus on risk assessment of M3Ms

What criteria based upon plain films should we request a CBCT?

Should all high risk teeth, as assessed on plain film, undergo CBCT?

- assessment prior to removal if they have to be extracted?

Is there an advantage of CBCT over plain films in decision making?

- Minimizing radiation

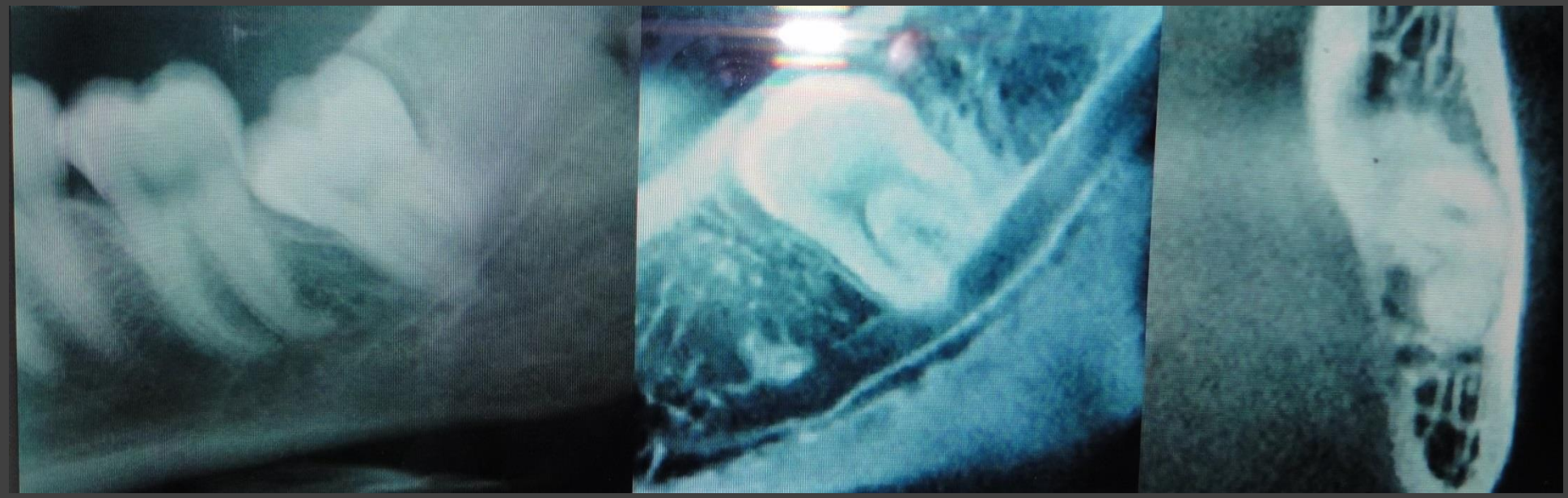
What is the role of the Oral Maxillofacial Radiologist- Liability issues?

What are the criteria on CBCT that dictates coronectomy or remov

Are you obligated to offer a coronectomy to your patient?

Assessment nerve ‘at risk’

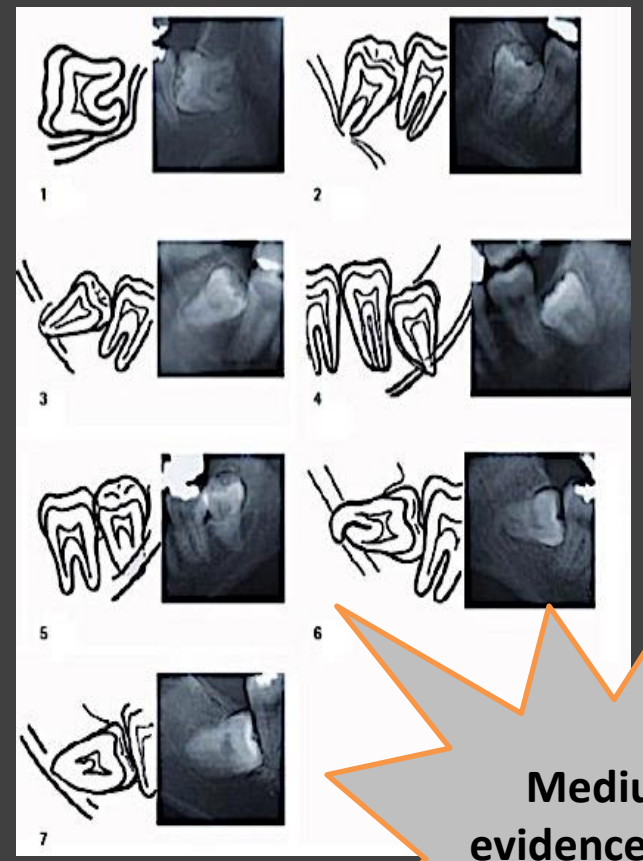
- Crossing lamina dura of IAN canal on plain film?
- Associated radiographic signs?



Radiographic Assessment for increased risk of IANI- Plain film signs

What are the plain film indicators of IAN risk?

- IAN plain film risk factors include:
  - Diversion of the canal
  - Darkening of the root
  - Narrowing of the root/canal
  - Interruption of the canal lamina dura.
  - Interruption of the juxta-apical area.



Y. Hatano, K. Kurita, Y.Kuroiwa, H. Yuasa & F
14.Clinical evaluations of coronectomy (intentional p ny)
mandibular third molars using dental computed tom gra a c ontro
study, copyright (2009), with permission from Elsevier)

Medium evidence level

Howe J. et Poyton H: Prevention of damage to the inferior alveolar dental nerve during the extraction of mandibular third molars. Br. Dent J. 1960; 109:355 Rud J. The split-bone technique for removal of impacted mandibular third molars. J Oral Surg 1970; 28:416-421. Kipp D et al.: Dysesthesia after mandibular third molar surgery: A retrospective study and analysis o 1,377 surgical procedures. J Am Dent Assoc. 1980; 100: 185. Rood JP. Lingual Split Technique: Damage to Inferior Alveolar and Lingual Nerves during Removal of Impacted Mandibular Third Molars. Br Dent J 1983; 154: 402-403. Rud J. Re-evaluation of the lingual split bone technique for the removal of impacted mandibular third molars. J Oral Maxillofac Surg. 1984; 42: 114.

What's the risk?
Tooth roots proximal to Inferior dental canal IDC

Medium evidence level

Low risk extraction
- **2% of temporary**
- **0.2% of permanent**

High risk extraction

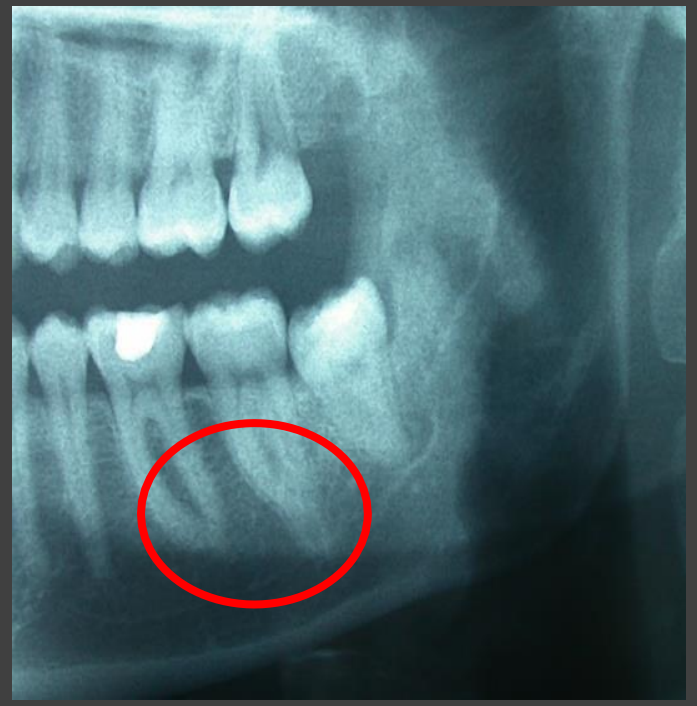
(teeth are superimposed on the IAN canal)
- **20% temporary**
- **2% permanent**

Risk factors
- increased age
- difficulty of surgery
- proximity to the IAN canal

10 x

- Renton T, Hankins M, Sproate C, McGurk M.A randomised controlled clinical trial to compare the incidence of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars. Br J Oral Maxillofac Surg. 2005 Feb;43(1):7-12
- Rood JP, Shehab BA.The radiological prediction of inferior alveolar nerve injury during third molar surgery.Br J Oral Maxillofac Surg. 1990 Feb;28(1):20-5
- Rud J.Third molar surgery: perforation of the inferior dental nerve through the root. Tandlaegebladet. 1983 Oct;87(19):659-67. No abstract available.

Remember not JUST M3Ms
Other teeth can be high risk too!



Risk assessment based upon plain films relating to CBCT findings

- Radiographic findings in the Panorex having the highest correlation with a true relationship to the IAN included:

- 1. **Superimposition of canal on root with radiolucent area (darkening) and loss of one or both white lines;**
- **2. Root apex just touched top of the outline of the IAN**
- **3. Darkening of the root combined with Deflection of root Narrowing of root Narrowing of canal**
- **4. +/- Deflection of canal.**

- *Although some inconsistency exists, it is also important to remember that not only do positive radiographic findings not correlate 100 percent to the development of nerve impairment, absence of radiographic signs does not ensure that injury will not occur.*

Dalili Z, Mahjoub P, Sigaroudi AK. Comparison between cone beam computed tomography and panoramic radiography in the assessment of the relationship between the mandibular canal and impacted class C mandibular third molars. Dent Res J. 2011;8:203

Roberto Pippi. Inferior Alveolar Nerve Entrapment. J Oral Maxillofac Surg 68:1173-1178, 2010

How many M3Ms are at high risk?

Fate	M3Ms	% of sub group of M3Ms	% of all M3Ms	Reference
Missing	8/100	8 (0.15% and 16.2%)	8	Rakhshan V Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment Dent Res J (Isfahan). 2015 Jan-Feb; 12(1): 1–13.
Impacted non communicating with mouth= retain	8-18/92	7-13%	6 15	Jung JH Cho BH. Prevalence of missing and impacted third molars in adults aged 25 years and above Imaging Sci Dent 2013 Dec; 43(4): 219–225. Dodson T Impacted wisdom teeth BMJ Clin Evid 2010; 2010: 1302.
Requiring removal or coronectomy at some stage			2 11	no evidence but 2% risk of permanent IANI Howe J, Poyton H. Prevention of damage to the inferior alveolar dental nerve during the extraction of mandibular third molars. Br. Dent J. 1960; 109:355
High risk based upon panoral radiography	35/80	(7.5% /80) 36% 32.1% 29&	**11** 39 35	Howe J, Poyton H. Prevention of damage to the inferior alveolar dental nerve during the extraction of mandibular third molars. Br. Dent J. 1960; 109:355 Sedaghatfar M, August MA, Dodson T. Panoramic Radiographic Findings as Predictors of Inferior Alveolar Nerve Exposure Following Third Molar Extraction. American Association of Oral and Maxillofacial Surgeons J Oral Maxillofac Surg 63:3-7, 2005 Smith Aus Dent J 2012
High risk based upon CBCT	30/35	46.7% direct contact IDC	**42**	Schneider T et al Variations in the anatomical positioning of impacted mandibular wisdom teeth and their practical implications. Swiss dental Journal. 124: 520–529 (2014)
High risk requiring coronectomy	/35	5.6%	3.5	Peker Y, Sarikir S, Alkurt MT, Zor ZF.Panoramic radiography and cone-beam computed tomography findings in preoperative examination of impacted mandibular third molars. *BMC Oral Health*2014**14**:71

Coronectomy prevents nerve injury
Are you obligated to offer coronectomy to higher risk patients?

- **There is a case NHSLA admitted that in 2009 it was a breach of duty not to offer a patient with high risk M3M a coronectomy if assessed at higher risk on DPT**
- Then July 2014 Cochrane review stated that likely that coronectomies reduce the risk of IANI
- Efficacy of coronectomy in reducing nerve injury?

Systematic review 2012 The authors stated that coronectomy could be used in clinical practice, for third molar extractions, with a high risk of nerve injury. The risks of failed coronectomy could be reduced by improving surgical procedures and by monitoring radiographic risk factors.Long H, Zhou Y, Liao L, Pyakurel U, Wang Y, Lai W. Coronectomy vs total removal for third molar extraction: a systematic review. Journal of Dental Research 2012; 91(7): 659-665

Systematic review 2016 Coronectomy is indicated when the mandibular third molar is in contact with the inferior alveolar nerve and complete removal of the tooth may cause nerve damage.Cervera-Espert J , Pérez-Martínez S, Cervera-Ballester J, Peñarrocha-Oltra D, Peñarrocha-Diago M. Coronectomy of impacted mandibular third molars: A meta-analysis and systematic review of the literature. Med Oral Patol Oral Cir Bucal. 2016 Jul 1;21(4):e505-13.

Martin *et al. Head & Face Medicine* (2015) 11:9
DOI 10.1186/s13005-015-0068-7

HEAD & FACE MEDICINE

REVIEW Open Access

Coronectomy as a surgical approach to impacted mandibular third molars: a systematic review

Andrea Martin, Giuseppe Perinetti, Fulvia Costantinides* and Michele Maglione

Abstract

The aim of this systematic review was to evaluate the clinical effectiveness of the surgical technique of coronectomy for third molars extraction in close proximity with the inferior alveolar nerve.
A literature survey carried out through PubMed, SCOPUS and the Cochrane Library from inceptions to the last access in January 31, 2014, was performed to intercept randomised clinical trials, controlled clinical trials, prospective cohort studies or retrospective studies (with or without control group) that examined the clinical outcomes after coronectomy. The following variable were evaluated: inferior alveolar nerve injury, lingual nerve injury, postoperative adverse effects, pulp disease, root migration and rate of reoperation. Ten articles qualified for the final analysis. The successful coronectomies varied from a minimum of 61.7% to a maximum of 100%. Coronectomy was associated with a low incidence of complications in terms of inferior alveolar nerve injury (0%-6.5%), lingual nerve injury (0%-2%), postoperative pain (1.1%-41.9%) and swelling (4.6%), dry socket infection (2%-2%), infection rate (1%-9.5%) and pulp disease (0.9%). Migration of the retained roots seems to be a frequent occurrence (2%-85.3%).
Coronectomy appears to be a safe procedure at least in the short term reduced incidence of postoperative

Medium evidence level
4 Prospective randomised trials

Should we undertake a coronectomy based upon plain films ONLY and not progress to CBCT?

No evidence level

No because 96-98% of patients can have removal of their M3Ms with CBCT risk assessment (if you proceed with coronectomy for all cases 96-98% of patients get the wrong surgery and are exposed to additional complications)

Realistically Only 2% of patients need coronectomy, (Acknowledging the attendant post surgical risks)

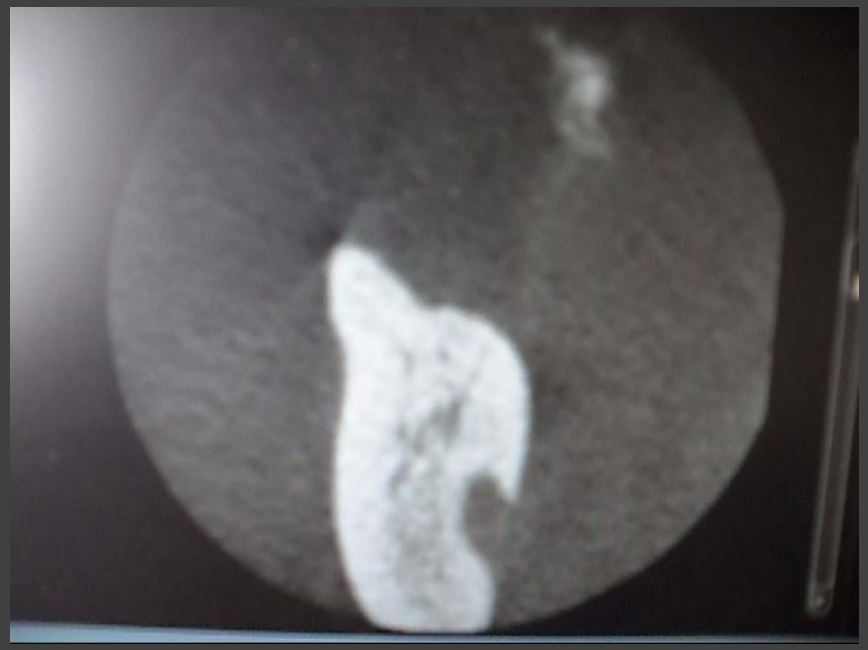
Medium evidence level
4 Prospective randomised trials

Coronectomy does prevent nerve injury in selected cases

Unfortunate case:

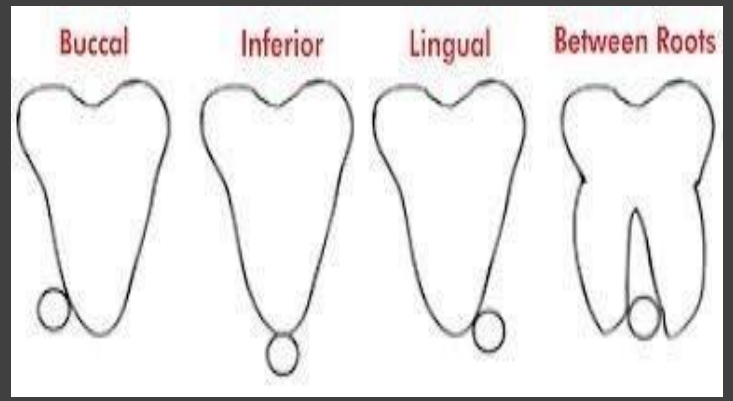
Booked for coronectomy but had removal

Now patient has permanent IANI

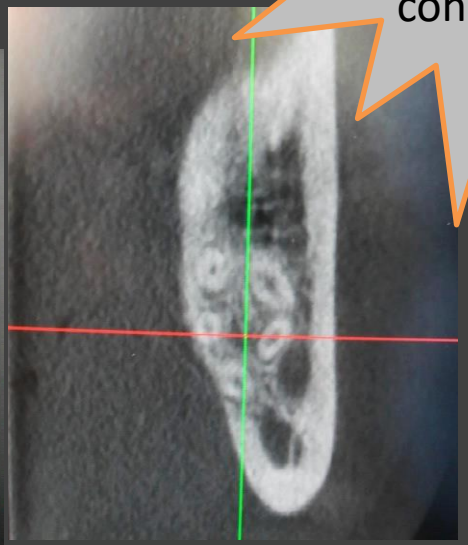


Issue 2 Does CBCT provide necessary additional information to enhance decision for coronectomy and protection of the IAN?

- What about radiation exposure?
- Reduction of exposure
  - high speed
  - half rotation
  - Reduced field of view



Low -Mod evidence level
4 Prospective cohort trials



Perforation is the only ‘Absolute’ indication for coronectomy

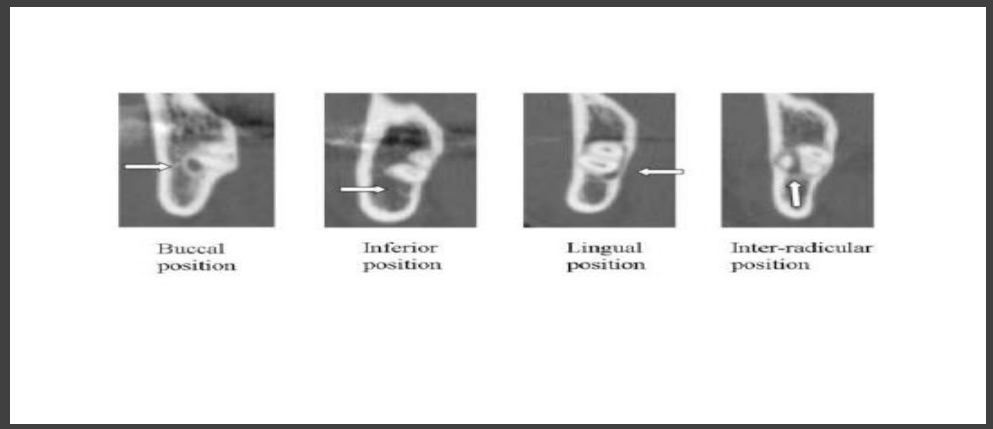
Removal of perforated teeth cause permanent harm.

If perforation identified = coronectomy

Roberto Pippi. Inferior Alveolar Nerve Entrapment. J Oral Maxillofac Surg 68:1173-1178, 2010

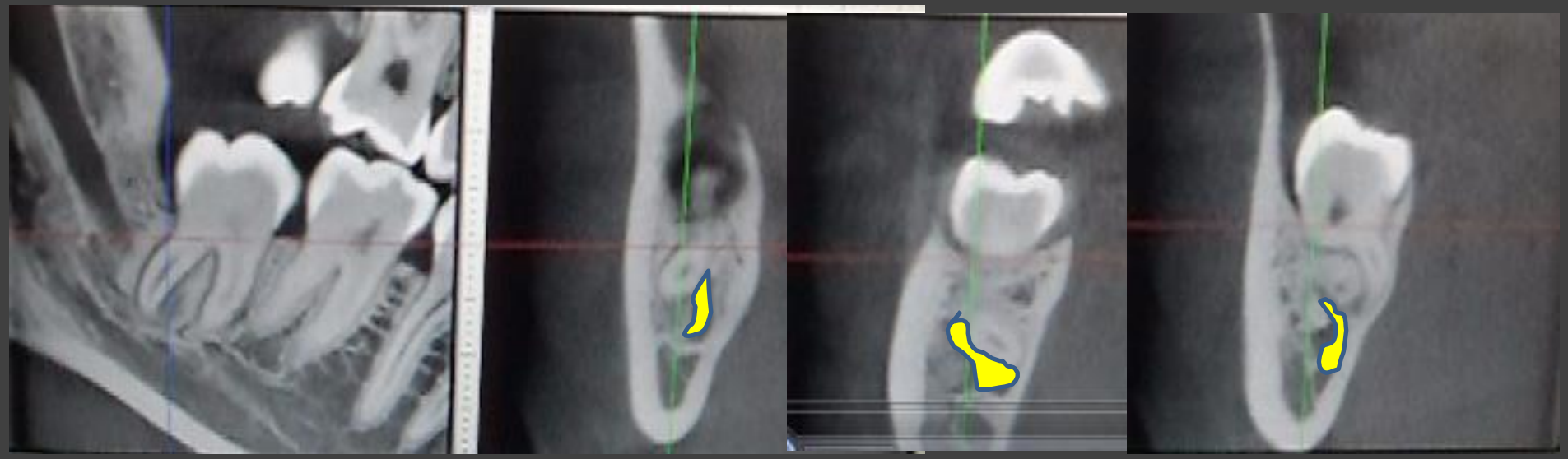
Perforation is rare more likely ‘intimately’ associated

Reference	cases	Buccal	Inferior	Lingual	Inter radicular
Kaeppler et al 2000	345	53.6	6	13	26.8
Mahasantipiy 2000	202	15.3	42.6	30.2	12.4
Ito et al1994	47	55.3	36.2	2.1	6.4
Tanaka et al 2000	209	39.2	47.4	10	3.3
Hashizum et al 2004	68	23.5	33.8	39.7	2.9
Maegawe et al 2003	47	51.1	19.1	25.5	4.3



M3M perforation is very rare but ‘snake’ nerve are more common

The nerve doesn’t have to ‘perforate’ tooth but…….



‘Snake’ nerves

J Clin Exp Dent. 2015;7(2):e224-31.

Classification of impacted third molars

Journal section: Oral Surgery
Publication Types: Research

doi:10.4317/jced.51984
http://dx.doi.org/10.4317/jced.51984

Classification of impacted mandibular third molars on cone-beam CT images

Michele Maglione [1], Fulvia Costantinides [2], Gabriele Bazzocchi [3]

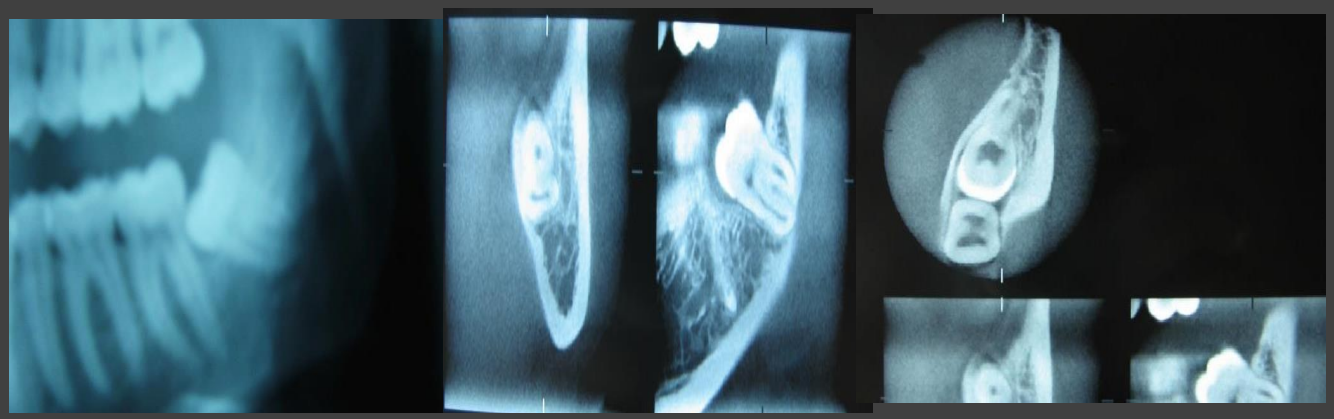
Class	Subtype	Scheme of the relationship betwee tooth/IAN*
Class O: the mandibular canal is not visible on the images (plexiform canal).	-	
Class 1: the mandibular canal runs apically or buccally with respect to the tooth but without touching it (the cortical limitations of the canal are not interrupted).	**1A**: the distance IAN/tooth is greater than 2 mm.	
	1B: the distance IAN/tooth is less than 2 mm.	
Class 2: the mandibular canal runs lingually with respect to the tooth but without touching it (the cortical limitations of the canal are not interrupted).	**2A**: the distance IAN/tooth is greater than 2 mm.	
	2B: the distance IAN/tooth is less than 2 mm.	
Class 3: the mandibular canal runs apical or buccal touching the tooth.	**3A**: in the point of contact the mandibular canal shows a preserved diameter.	
	the mandibular canal shows a smaller calibre and/or an interruption of the corticalization.	
Class 4: the mandibular canal runs lingually touching the tooth.	**4A**: in the point of contact the mandibular canal shows a preserved diameter.	
	4B: in the point of contact the mandibular canal shows a small calibre and/or an interruption of the corticalization.	
Class 5: the mandibular canal runs between the roots but without touching them.	**5A**: the distance IAN/tooth is greater than 2 mm.	
	5B: the distance IAN/tooth is less than 2 mm.	
Class 6: the mandibular canal runs between the roots touching them.	**6A**: in the point of contact the mandibular canal shows a preserved diameter.	
	6B: in the point of contact the mandibular canal shows a small calibre and/or an interruption of the corticalization.	
Class 7: the mandibular canal runs between fused roots	-	

I would ONLY coronect grades 6 and 7!!

Michele Maglione, Fulvia Costantinides, Gabriele Bazzocchi Classification of impacted mandibular third molars on cone-beam CT images J Clin Exp Dent. 2015 April; 7(2): e224–e231. Published online 2015 April 1. doi: 10.4317/jced.51984

Role CBCT in localising IDC in relation to tooth roots

- Localising IAN proximal to roots
- DISTANT from nerve

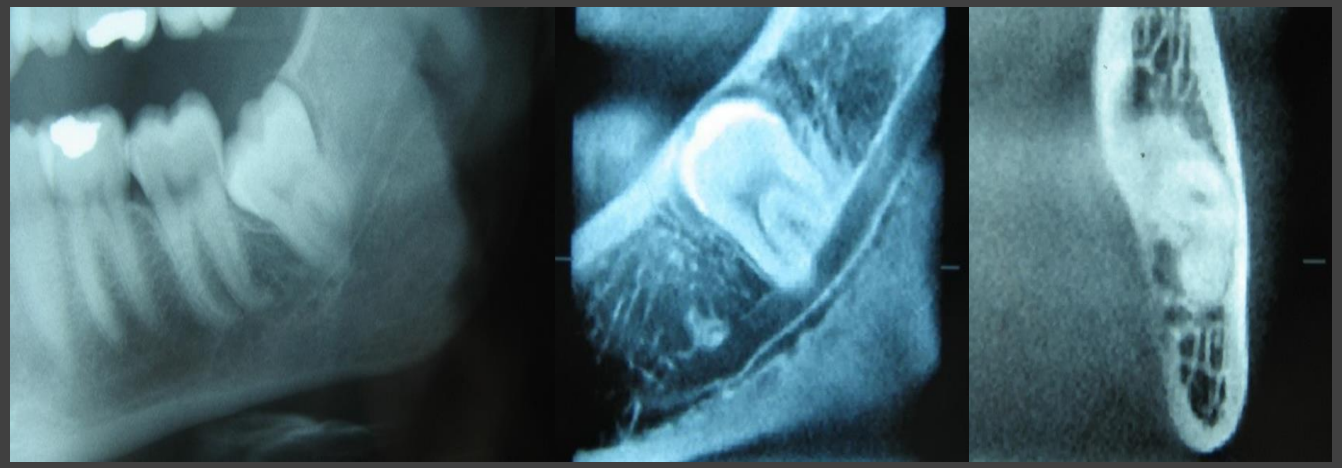


IDC Distant = Removal

Role of CBCT in localising IDC

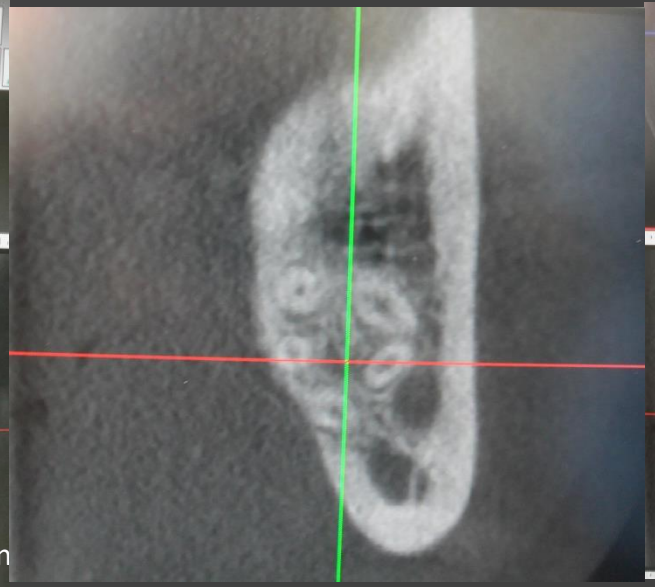
Localising IAN proximal to roots

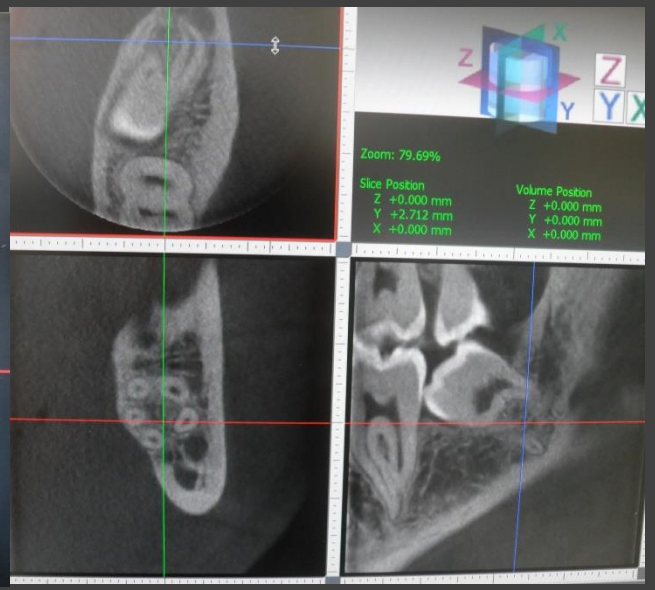
PROXIMAL to nerve



Proximal IDC = Coronectomy?

In my practice CBCT provides ability to assess M3M root morphology and relationship to IDC and avoid coronectomy in 96-98% of cases





Kings College London-Tara Renton

Most of my coronectomy decisions are based upon Snake interproximal nerves

How close does the nerve have to be?

The nerve doesn’t have to ‘perforate’ tooth…

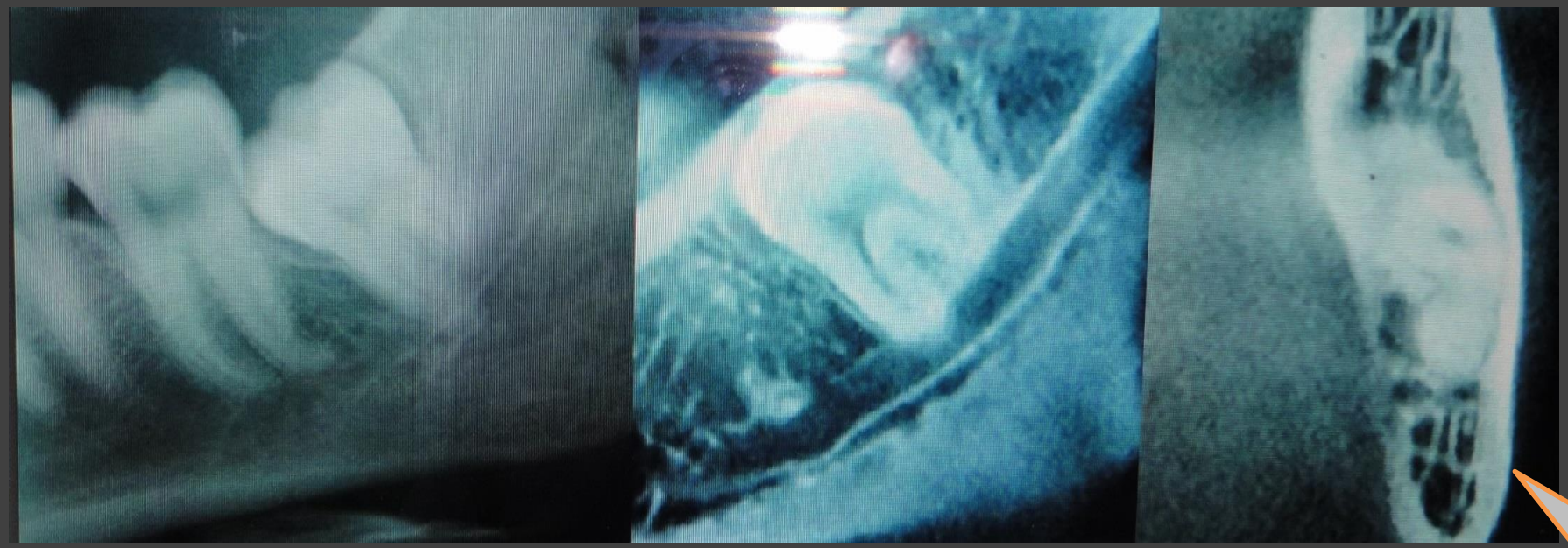
DO not rely on radiologists report

Read the CBCT your self!

CBCT Radiation dose reduction

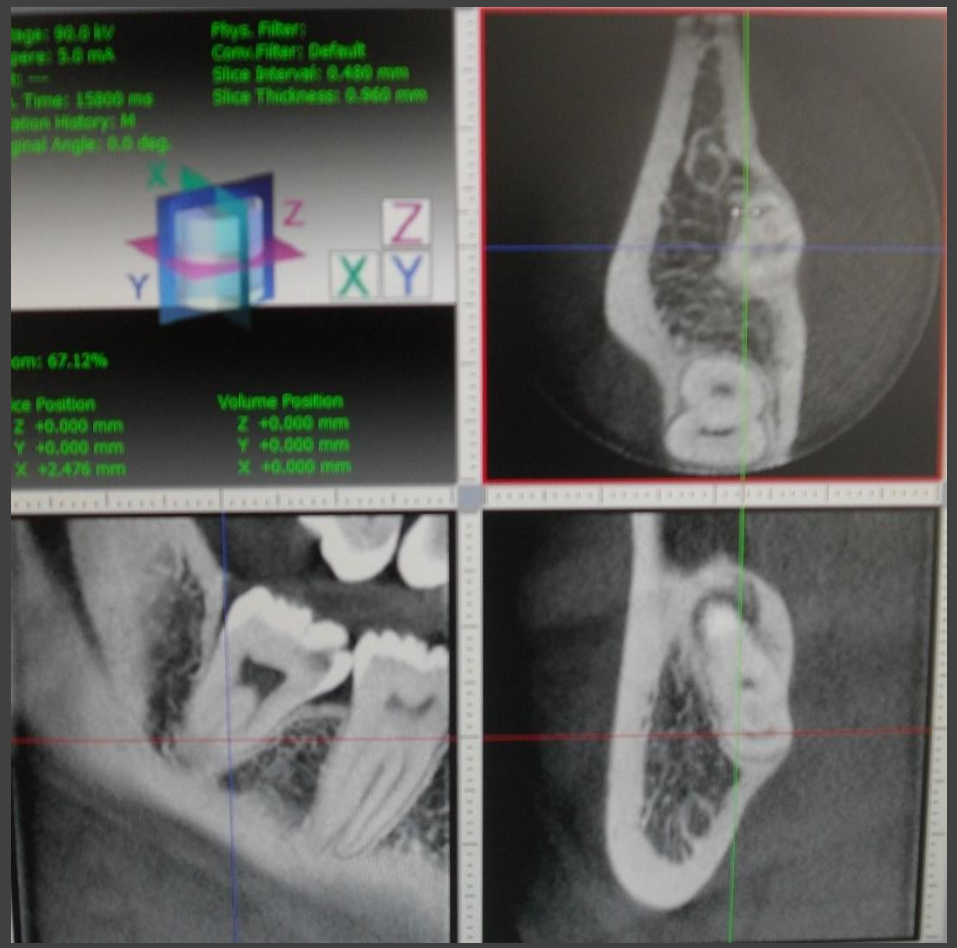
J Brown, A Darwood, C Gleeson T Renton. Minimising radiation exposure during assessment of high risk M3Ms.

Issue 4 Can CBCT predict IANI and prevent it?



Mixed opinions low evidence

Can CBCT predict IANI Low risk - removal



- IDC distant
- IDC Buccal to M3M roots
- IDC inferior to roots

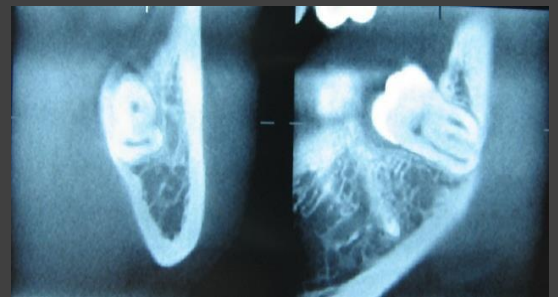
low evidence

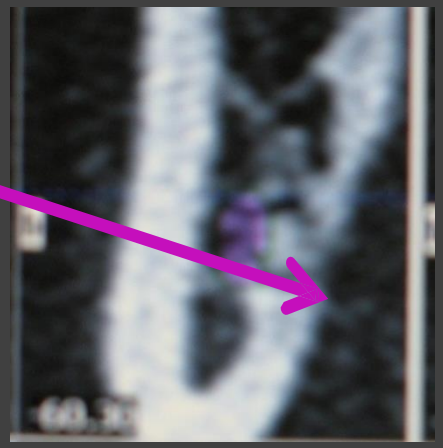
Can CBCT predict IANI Increased risk to the IANI

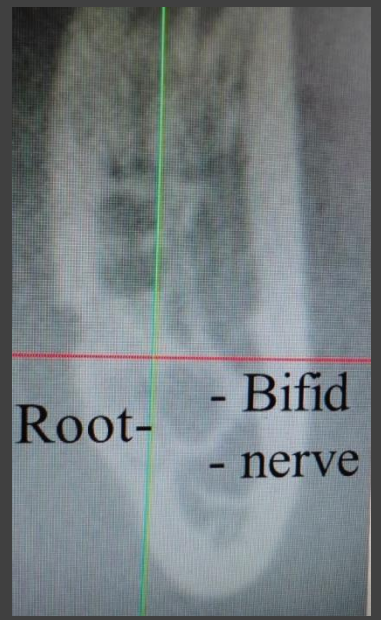
- Major risk factors associated with IAN injury is the cortical perforation of the IAC by the root(s) or crown of the 3rd molar. *Nakagawa, Susarla, Tantanapornkul W, Ueda.*
- Cortical perforation of the IAC, as seen on CT, correlates with darkening of the root seen on panoramic radiography. *Rood, Park, Ueda*
- ***30% rule***

30%

- Check deformation &/or cortication of the IDC
- Check for bifid canal
- Loss of lingual cortex







High risk factors for IANI -CBCT

- Risk factors
  - Decortication of canal > 3mm
    - The length of the IAC perforation or defect depends on: Impaction depth and angulation of a M3.
      - *Susarla et al JOMS 2010:* A **cortical defect length** (distance) of at least 3 mm on CT scan has been associated with an increased risk for intraoperative IAN exposure
  - Distortion of the IDC – dumbbell shape
    - Shape of the IAC at the point of contact with a M3.The intimate proximity of a M3 can modify the common oval configuration of the canal toward a more 'dumbbell' or 'tear- drop' shape or a concave configuration.
      - *Tolstunov et al 2014:* **Invagination of the IAC** - 'compression' (concave deformation) of the IAC resulting from the proximity of root(s) of a M3.
  - IDC lingual to roots
    - Of the 440 teeth, according to CT scanning, 146 (33.2%) IANs were in the buccal position, 195 (44.3%) were in the inferior position, 95 (21.6%) were lingual, and 4 (0.9%) were in the inter-radicular position. The ratio of IANI in the extraction group with a lingual position between the roots was significantly higher ($P < 0.05$) than that in the group with other positions. Through the logistic regression model the close relationship of the roots to the IAN on CT examination is a significant variable in predicting an injury after M3 extraction ($P < 0.000$).
      - Hasegawa et al. [Hasegawa T, Ri S, Shigeta T, Akashi M, Imai Y, Kakei Y, Shibuya Y, Komori T. Risk factors associated with inferior alveolar nerve injury after extraction of the mandibular third molar--a comparative study of preoperative images by panoramic radiography and computed tomography. Int J Oral Maxillofac Surg. 2013 Jul;42(7):843-51. Epub 2013 Mar 15.] published a study in 2013 in which 440 M3s were removed.

Does CBCT change our surgical practice? Only in 12% of cases???????????

- Of the 20% (39 of 186 third molars) of the examined teeth within the coronectomy group, the highest impact factor for this decision was direct contact (no bony separation) between the third molar and the mandibular canal.

- Direct contact was, however, not a sufficient factor for deciding on coronectomy (37 coronectomies out of 91 teeth with direct contact), but in combination with lumen narrowing and the canal positioned in a bending or a groove of the root complex was favoured at the expense of removal of the entire tooth.

- The present strategy resulted in two cases with temporary sensory disturbances (1.08%), and none were permanent.

In my practice changes the decision from coronectomy to removal in 96-98% of cases

Matzen LH, Christensen J, Hintze H, Schou S, Wenzel A. Influence of cone beam CT on treatment plan before surgical intervention of mandibular third molars and impact of radiographic factors on deciding on coronectomy vs surgical removal. Dentomaxillofac Radiol 2013;42(1):98870341. doi: 10.1259/dmfr/98870341. Epub 2012 Aug 29. ONLY CHANGE IN SURGERY IN !"% OF CASES

SO if we had our radiographic assessment spot on……

We would ONLY undertake coronectomies on those teeth likely to cause permanent nerve injury = 2%

In my practise I undertake coronectomy on 5-6% of high risk cases so my practise changes due to CBCT in 94-95% of cases

Issue 5 Does coronectomy reduce nerve injury?

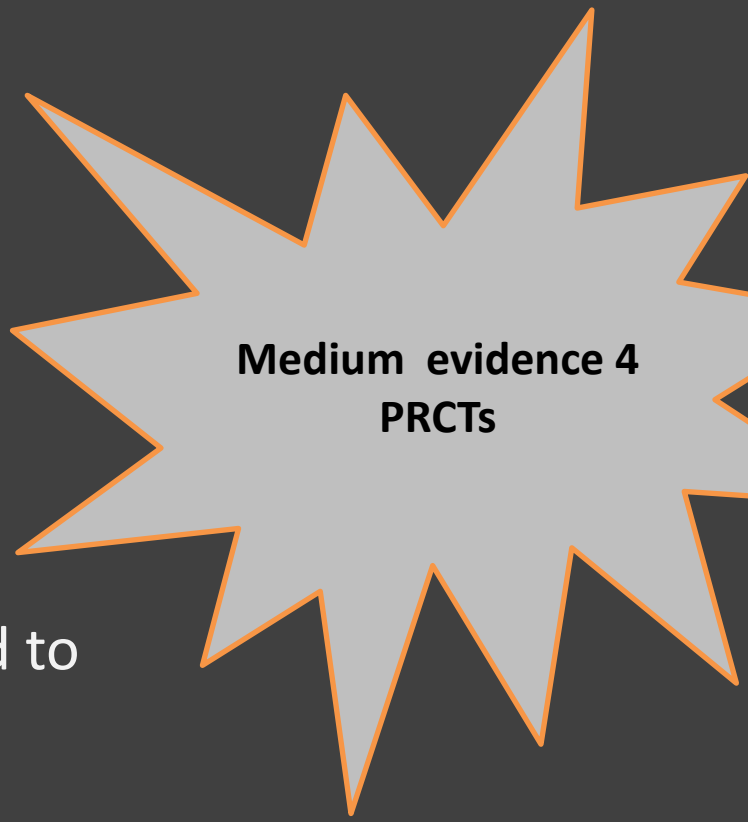
When should you consider a coronectomy?

Most important

- Tooth needs indication for removal
- Tooth MUST be high risk
  - (based upon CBCT ideally but can be on DPT)

Do not undertake coronectomy on low risk teeth

- Patient healthy and the tooth must be vital
- You cannot undertake coronectomy without being trained to remove the whole tooth!
- Informed decision making. The patient understands the risks!



M3M Removal or Coronectomy?

- Patient healthy?
- Patient reliable?
- Tooth vital?
- Tooth high risk- confirmed on CBCT inter radicular IAN?

- Yes to all

Coronectomy

- No to any?

Removal

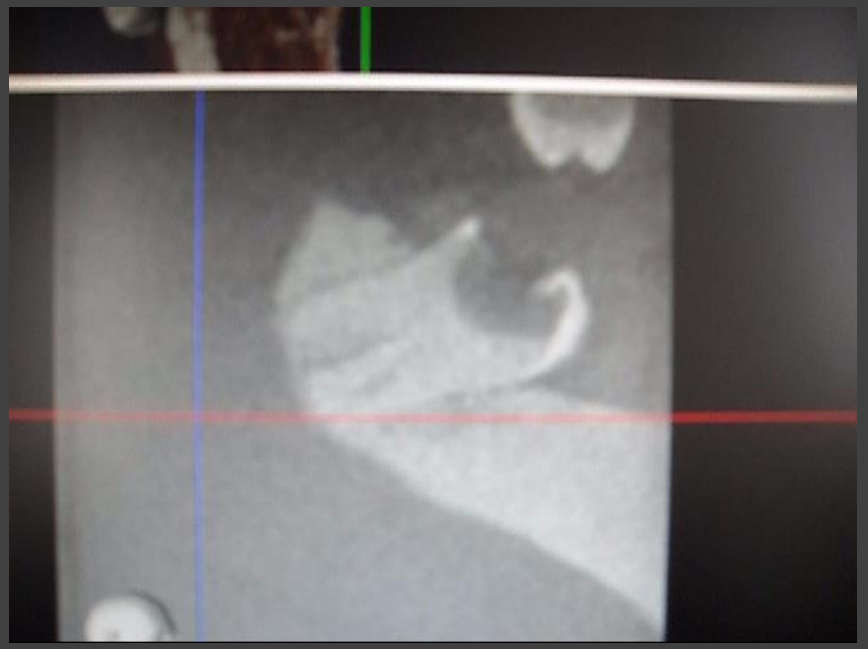
Contraindications for coronectomy

When should we NOT consider undertaking a coronectomy?

- Dental factors
  - Non vital tooth
  - Active caries into the pulp, or demonstrating periapical abnormality.
  - Teeth that are mobile should be excluded as they act as a mobile foreign body and become a nidus for infection or migration.
  - Teeth associated with tumors **
  - Horizontally impacted teeth more difficult
- Medical history
  - Immunocompromised patients (chemo- therapy, AIDS, radiation therapy, immunomodulating drug therapy, poorly controlled diabetics). Bisphosphonate medication
- Social psychological
  - Patient understanding is compromised
  - Travelling / difficult access to healthcare
- Other planned treatment
  - Patients scheduled for an osteotomy in the future.
  - Patients who are to undergo radiation therapy.

CBCT useful for Carious high risk tooth requiring removal to minimise IANI?

Even if a tooth is carious, and coronectomy is not possible, a CBCT may assist in your surgical planning



no evidence!!!!

Consent (Shared decision making)

- Consent for coronectomy is complicated and difficult for the patient to understand
  - *Link to leaflet on TNI website*
- Coronectomies ONLY be done for high risk teeth (ageing population, increasing medical complexity etc)
- **It is an adverse event to knowingly leave non high risk roots behind in a patient without informing patient**
- Need to explain radiographic factors to patient?
  - No need! As the patient satisfaction the same. 263 patients (with 301 mandibular third molars) were given pre-operative information by one of two trained scholar students before removal of the third molar

- Patient needs to understand potential **complications** including;
  - Mobilisation of roots intraoperatively
    - Remove roots
  - Early post operative infection >2 episodes of 'dry socket'
    - Treat as dry socket
    - ABs if spreading infection likley paraesthesia and neuropathy Remove roots
  - Late eruption <3% 3 years (Leung et al 2013; < 25 @ 5 years (Renton et al 2011)
  - Access consent sheet from Trigeminalnerve.org.uk

Effect of explaining radiographic information to the patient before third molar surgery. J Christensen, Louise Hauge Matzen, A Wenzel Dentomaxillofacial Radiology (Impact Factor: 1.27). 03/2010; 39(3):176-8. DOI: 10.1259/bjr/31553484

Coronectomy Technique

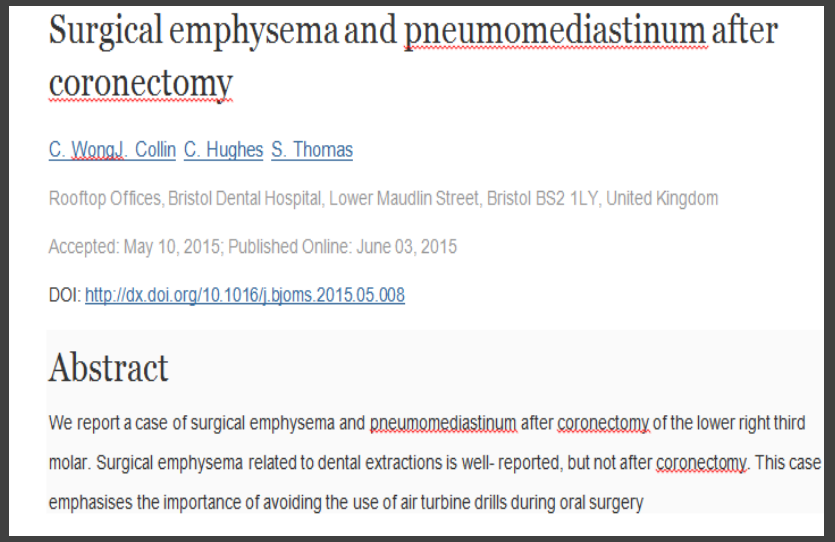
How to undertake coronectomy?

- Consent
- Stages of technique
  - LA
  - Flap
  - Bone removal
  - Tooth section
  - Lavage
  - Closure
- Follow up

Technique Don't trust you tube!!! Use BAOS videos How NOT to undertake coronectomy?

Videos of how to and how NOT to undertake coronectomy

- https://www.youtube.com/watch?v=WzSbL5KJfrM



Surgical emphysema and pneumomediastinum after coronectomy

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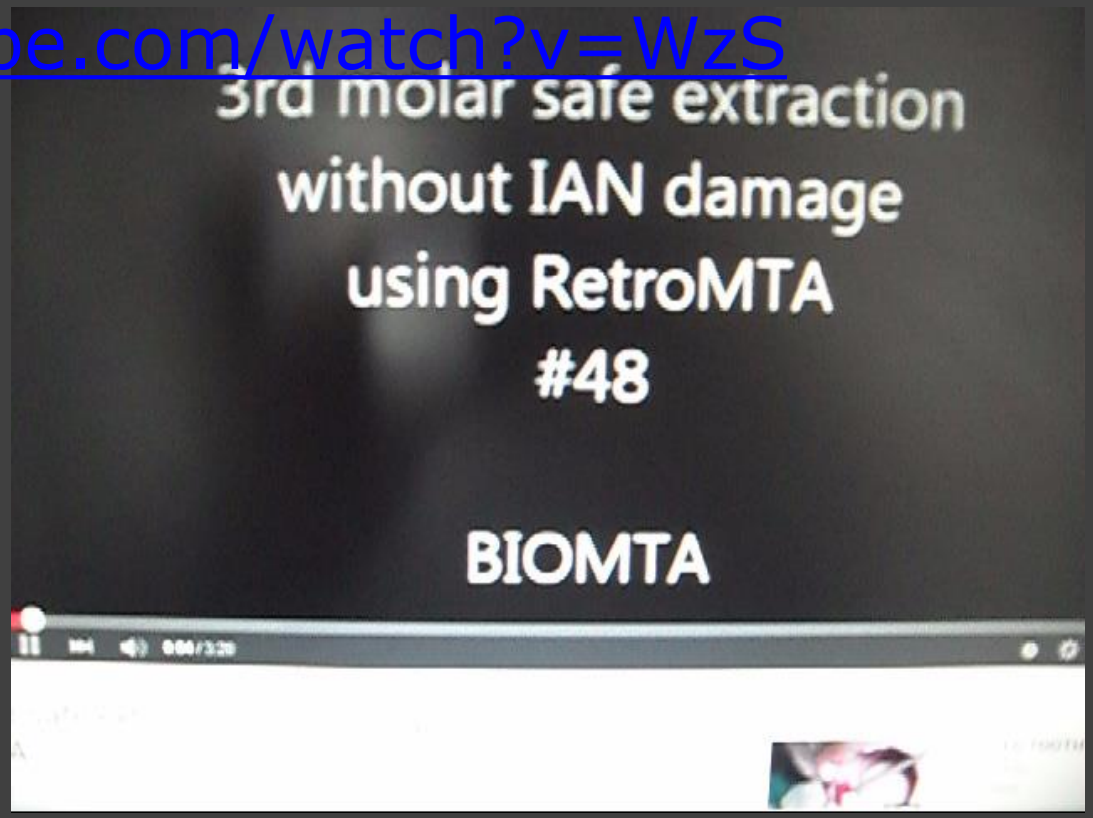
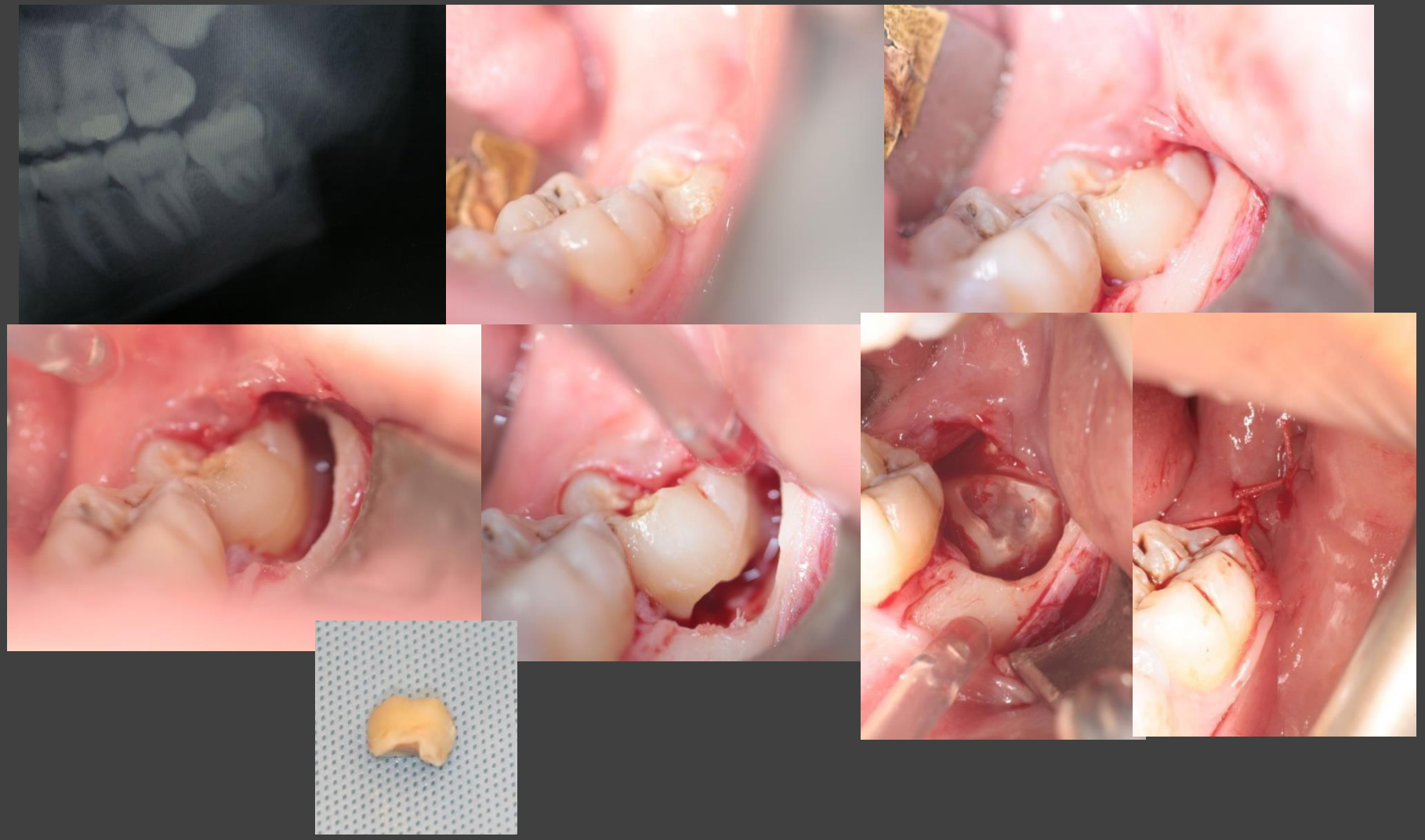
DOI: http://dx.doi.org/10.1016/j.bjoms.2015.05.008

Abstract

We report a case of surgical emphysema and pneumomediastinum after coronectomy of the lower right third molar. Surgical emphysema related to dental extractions is well- reported, but not after coronectomy. This case emphasises the importance of avoiding the use of air turbine drills during oral surgery



Less than 2% of high risk M3Ms need a coronectomy



Coronectomy Surgical technique – remove ALL enamel

Notes on coronectomy. **Renton T**. Br Dent J. 2012 Apr 13;212(7):323-6

Follow up

- **Home check essential**
  - Quality outcome assessment
  - Surgical audit
  - Patient satisfaction improved
  - Proactivity in picking up complications less complaints and claims

  - **NO radiographic follow up required**

Adjunctive needs?

- Antibiotic cover?
- Bone Graft?
- Pulp treatment?
- Closure?
- Repeat coronectomy with enamel retention?
  - Early repeat coronectomy for 10 of 185 cases successful

Should NOT be necessary if technique is correct in first instance!!!!!!

Coronectomy of the mandibular third molar: a retrospective study of 185 procedures and the decision to repeat the coronectomy in cases of failure. J Oral Maxillofac Surg 2015 Apr 22;73(4):587-94. Epub 2014 Oct 22. Boaz Frenkel, Navot Givol Yitzhak Shoshani

Hindawi Publishing Corporation
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Case Report

Modified and Grafted Coronectomy: A New Technique and a Case Report with Two-Year Followup

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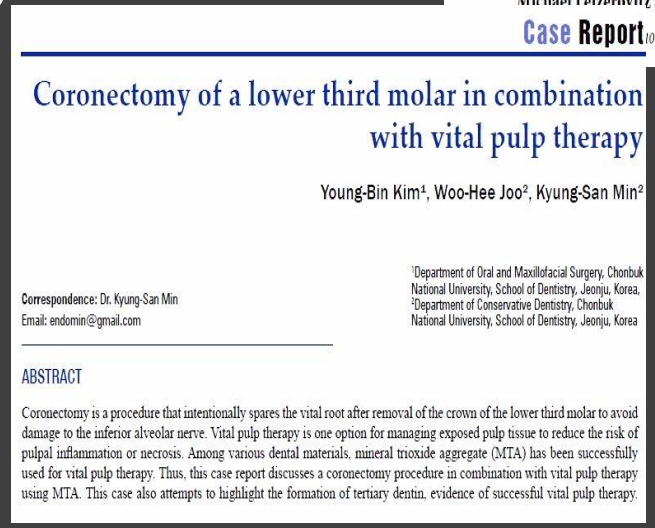
Case Report 10833 Le Conte Avenue, Los Angeles, CA 90095-1668, USA



Coronectomy of a lower third molar in combination with vital pulp therapy

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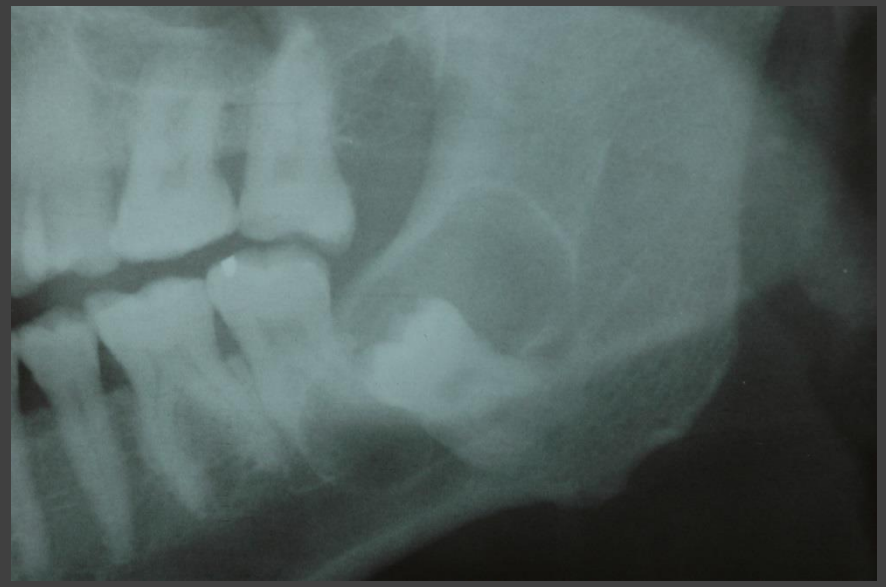
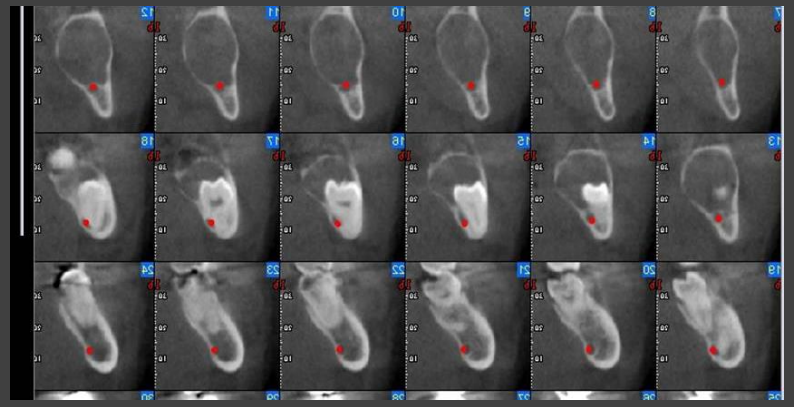
ABSTRACT

Coronectomy is a procedure that intentionally spares the vital root after removal of the crown of the lower third molar to avoid damage to the inferior alveolar nerve. Vital pulp therapy is one option for managing exposed pulp tissue to reduce the risk of pulpal inflammation or necrosis. Among various dental materials, mineral trioxide aggregate (MTA) has been successfully used for vital pulp therapy. Thus, this case report discusses a coronectomy procedure in combination with vital pulp therapy using MTA. This case also attempts to highlight the formation of tertiary dentin, evidence of successful vital pulp therapy.

Tailor your surgery minimise harm!

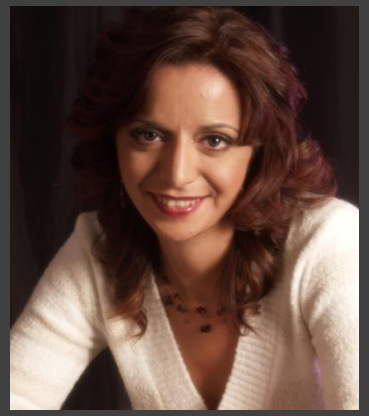
Coronectomy





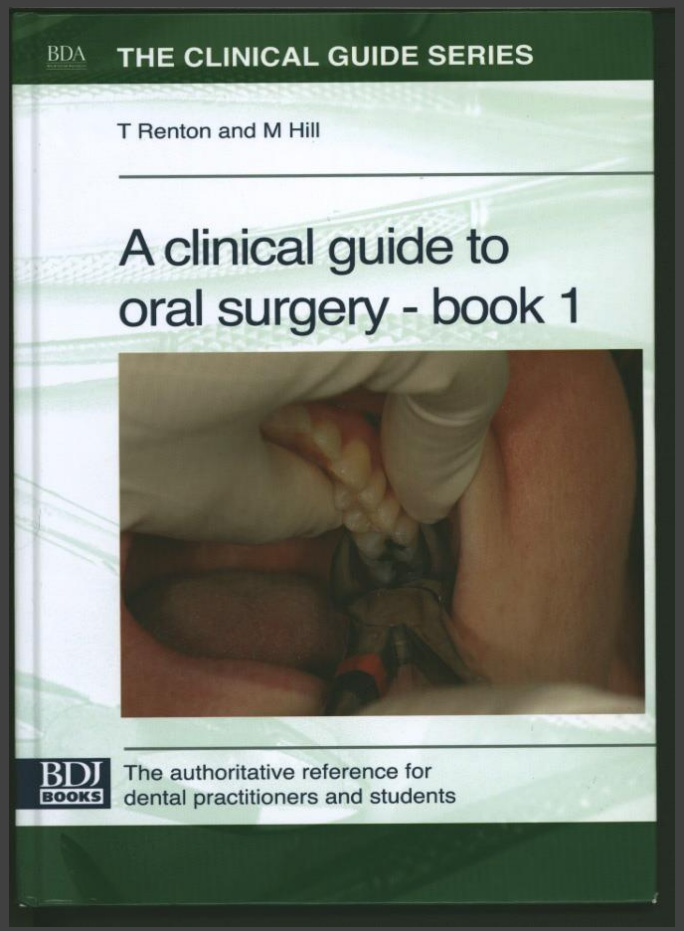
Well where is there any wisdom in M3M surgery?

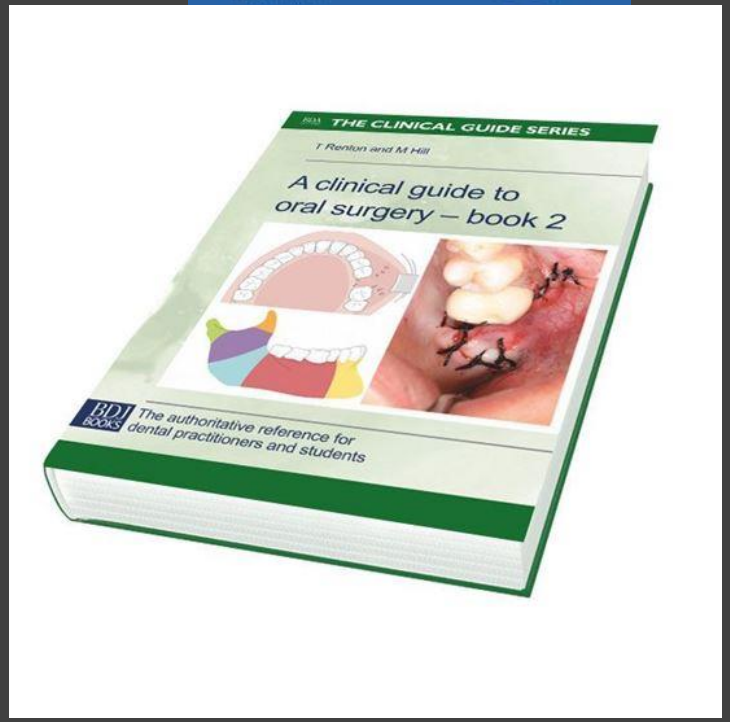
- Low evidence to support therapeutic extractions
- Low evidence for cost effectiveness and health benefit
- No evidence for clinical surveillance
- Medium evidence for interventional extractions
- No evidence for plain film risk factors changing practice or risk benefit to patients
- Low evidence to support CBCT preventing nerve injury or changing practice
- Medium evidence for retention of M3Ms causing M2M caries and delaying necessary surgery
- Medium evidence for coronectomy preventing nerve injury

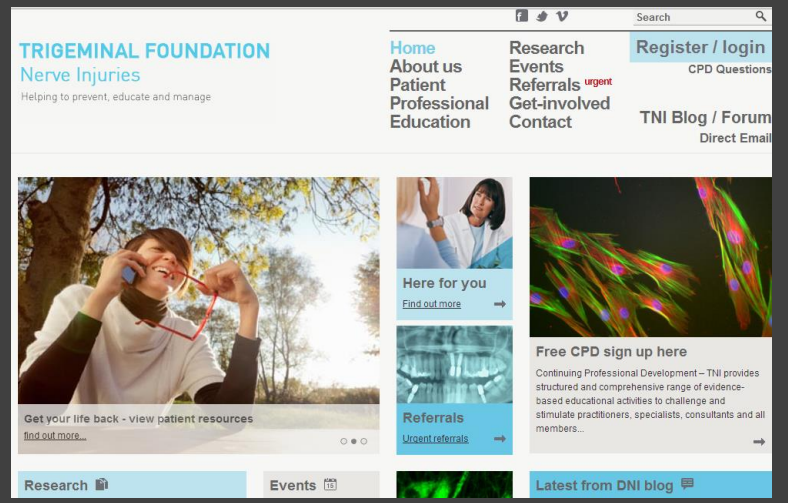


Thank you

Zehra Yilmaz

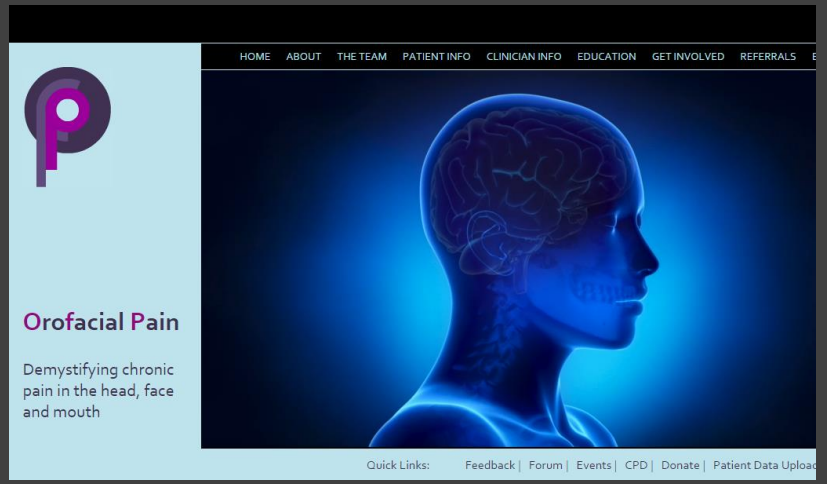






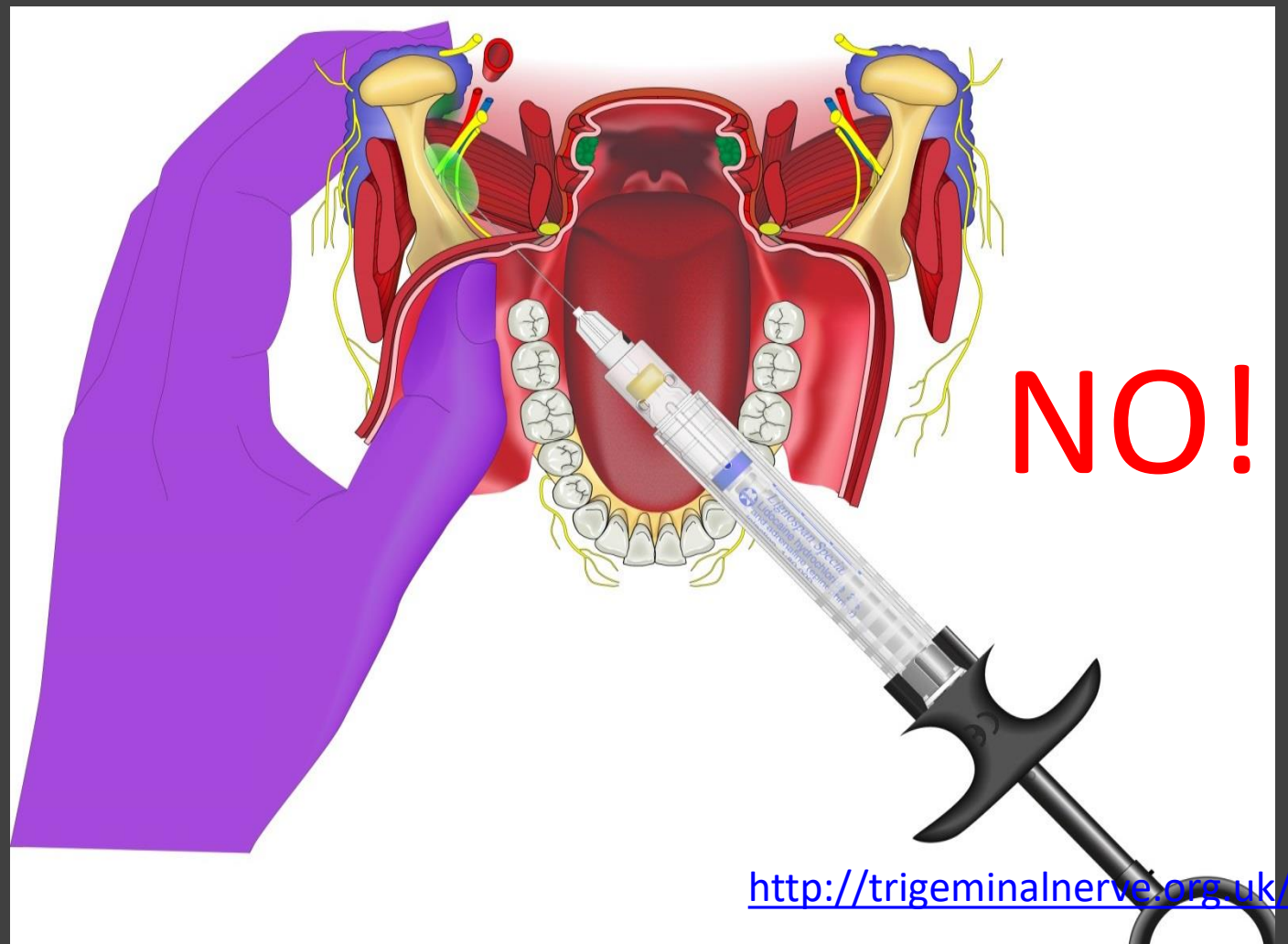
Trigeminalnerve.org.uk

Orofacialpain.org.uk



Techniques to avoid Nerve injury – Local anaesthesia

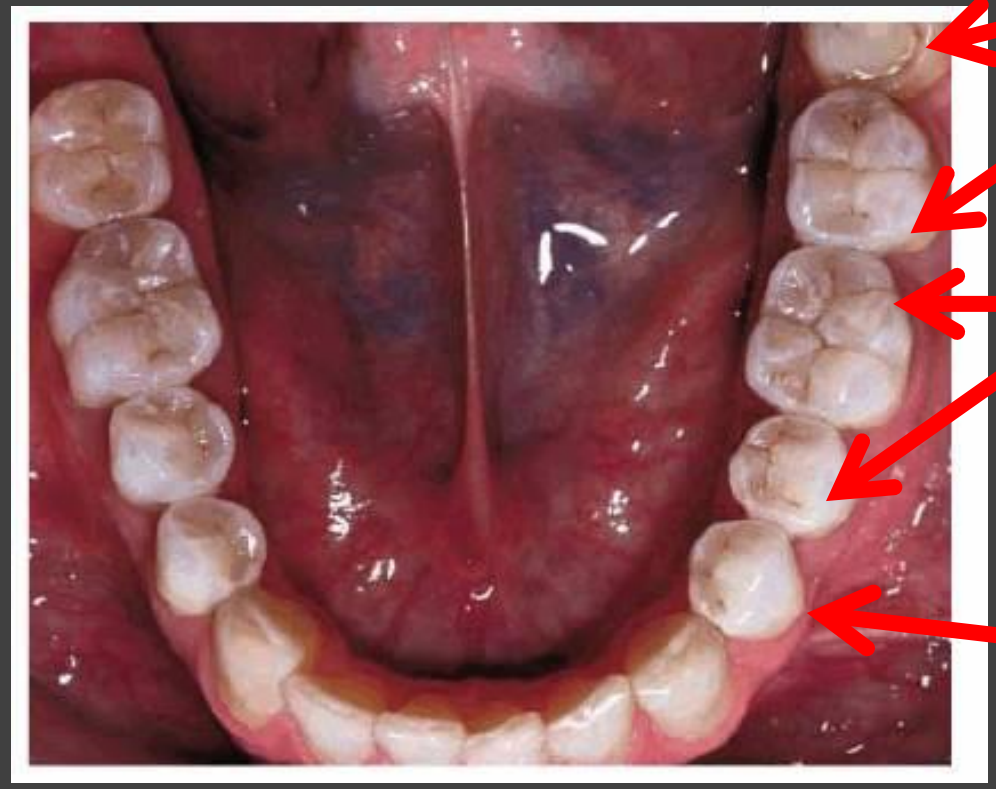
Should we always reach for the IDB?



Risk factors for persistent neuropathy related to IDBs In order to minimise complications related to dental LA you need to consider modifying the following risks;
• Block anaesthesia Nerve block injections should be undertaken without intent on direct 'hit' of the nerve. 60% of patients who experience the 'funny bone' neuralgia due to the IDB needle being placed too close to the lingual or inferior alveolar nerves experience persistent neuropathy (20)
• Lingual nerve > IAN Is this technique related or anatomically related (less fascicles in LN lower capacity for recovery). Perhaps the direct IDB approach may place the lingual nerve at increased risk compared with eth indirect technique. (14)
• Concentration of LA Any increased concentration of any agent leads to increased neural neurotoxicity (21)
• Volume of LA There is no evidence to support this suggestion but all chemicals are neurotoxic, dependent upon the proximity, LA concentration, neural damage additional volume would add to potential neurotoxicity.
• Multiple injections Second or subsequent injections that impede directly on or in neural tissue may not be associated with the usual 'funny bone' neuralgic pain. Thus the patient does not self-protect as effectively possibly rendering the nerves more at risk of direct damage.
• Severe pain on injection 60% increased occurrence of persistent neuropathy after IDBs (21)
• Type of LA Agent Bupivicaine most neurotoxic of all LA agents
• Type of vasoconstrictor? The role of vasoconstrictor in nerve damage is unknown
• Sedated or anaesthetized patients? There is no evidence to support unresponsive patients, are less likely to protect themselves when neuralgia (funny bone reaction) occurs as the IDB needle encroaches too close to the nerve.
• Lack of LA aspiration? Again there is no evidence to support that aspiration during IDB results in lower persistent neuropathies but a pragmatic view may infer less chemical injected intra neurally will cause less chemical nerve injury.

Infiltration techniques to avoid Nerve injury

‘Smart LA’ sub mucosal infiltration



- **Buccal articaine and lidocaine**
  Intra ligamenta lidocaine for M3Ms
- **Articaine 4% Buccal Infiltration +/- IDB Lidocaine 2%**
- **Articaine 4% Buccal Infiltration Post + ant near Mental foramen +/- Lingual Inf Lidocaine 2%**
  BI Articaine 4%>Lidocaine2%. Prilocaine 4% BUT 55% success
- **Buccal infiltration + Lingual both Lidocaine 2% Provides 90+% pulpal anaesthesia compared with 40-45% IDB**

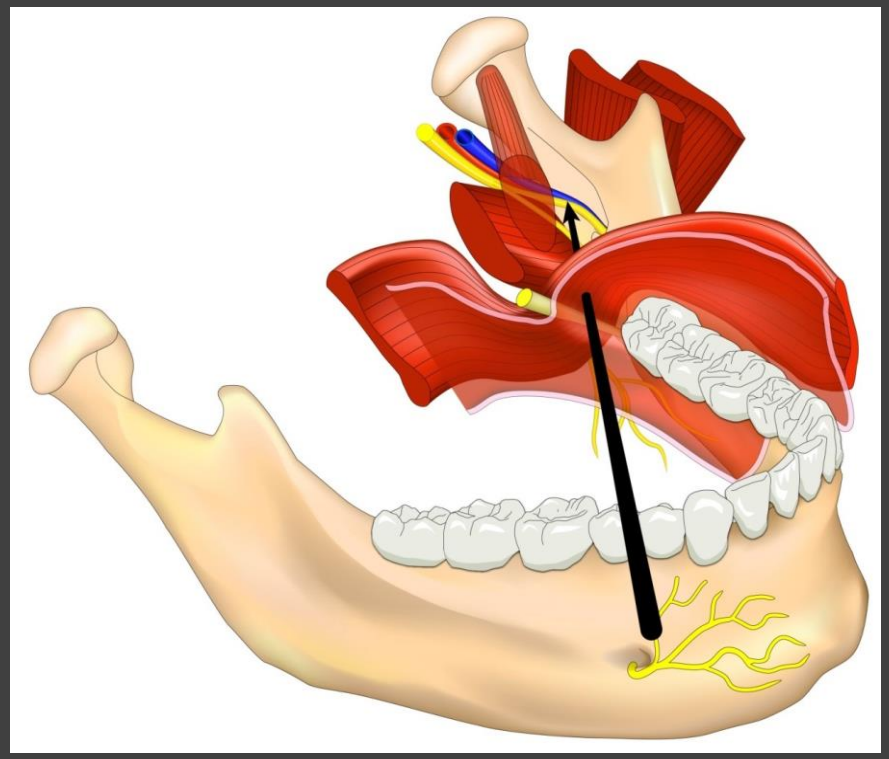
Meechan JG The use of the mandibular infiltration anaesthetic technique in adults. J Am Dent Assoc. 2011 Sep;142 Suppl 3:19S-24S.

Prevention –Modify Technique inferior dental block

Direct Halstead technique may place Lingual nerve at higher risk?

Consider indirect IDB technique
Or Gow Gates

Direct Halstead technique



Prevention of Inferior alveolar block inferior alveolar nerve injur

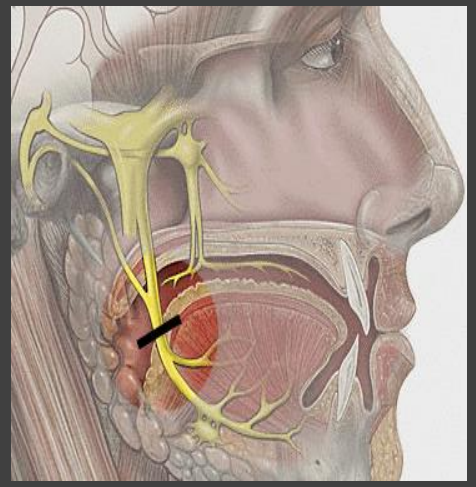
Most importantly prevention of nerve injuries is possible? The long term significant problems seen in patients with these nerve injuries is exemplified in that the;

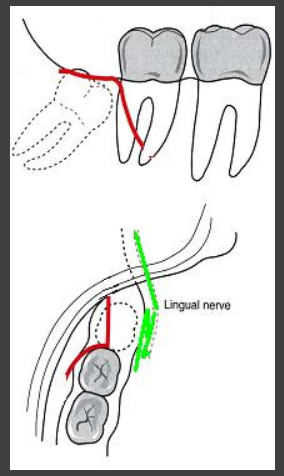
- **Nerve injuries cannot be 'fixed'.** We have to wait for resolution whilst managing the patient therapeutically using medical and psychological interventions. Thus there is no 'fix' for LA related nerve injuries only prevention.
- **25% of the nerve injuries are permanent**
- The injury is **related to high levels of dysthaesesia** and pain mainly affecting the tongue with attendant social and psychological impact
- **No warning** and patient has ever heard of them and the **resultant isolation for the patient is severe**. At least with consent patients are aware of these rare but possible injuries.
- **There is significant stress to both dentist and patient.**

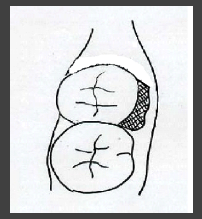
http://trigeminalnerve.org.uk/

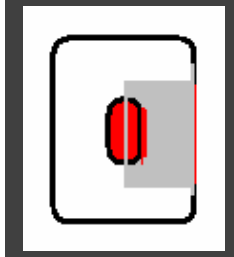
Prevention of Lingual nerve
Buccal approach -Minimal access prevents LNI

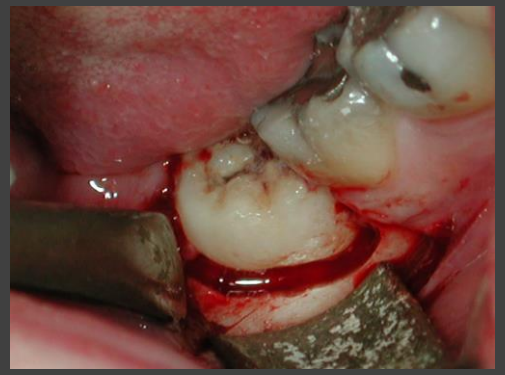
Old Technique ‘Explode the patient’









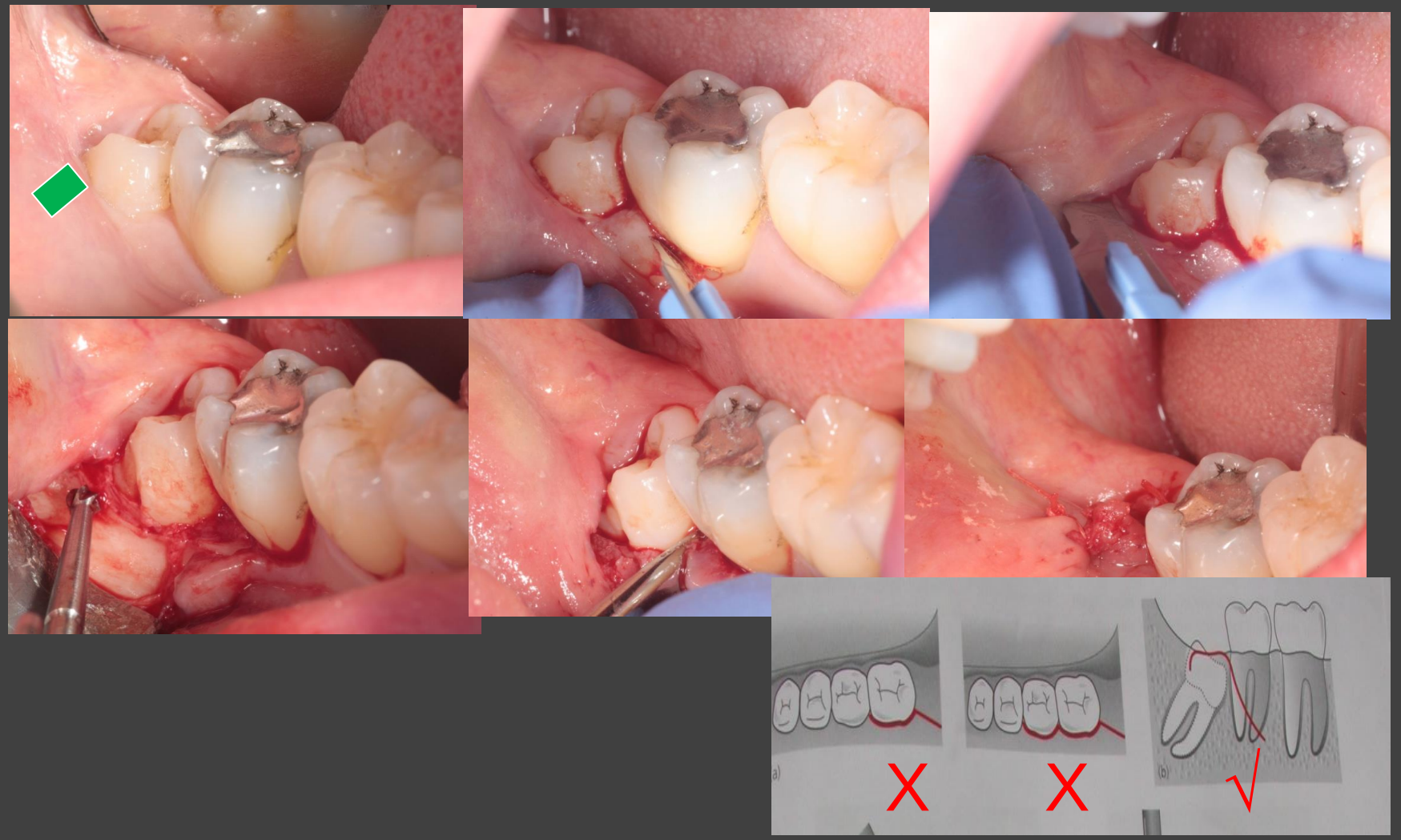


Evaluation of trigeminal nerve injuries in relation to third molar surgery in a prospective patient cohort. Recommendations for prevention. **Renton T**, Yilmaz Z, Gaballah K. Int J Oral Maxillofac Surg. 2012 Dec;41(12):1509-18.

Prevention

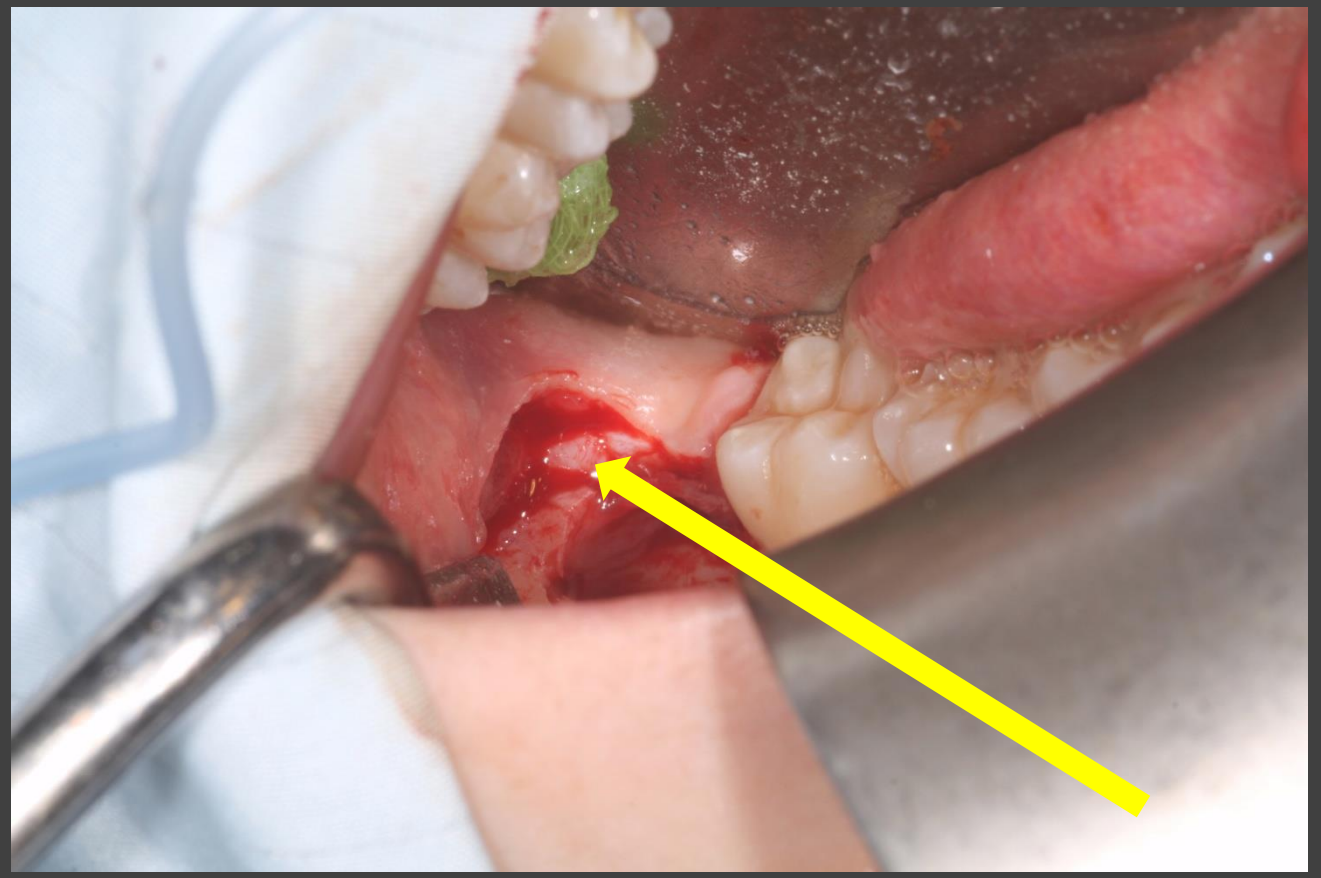
LNI related to M3M surgery

Buccal minimal access surgery



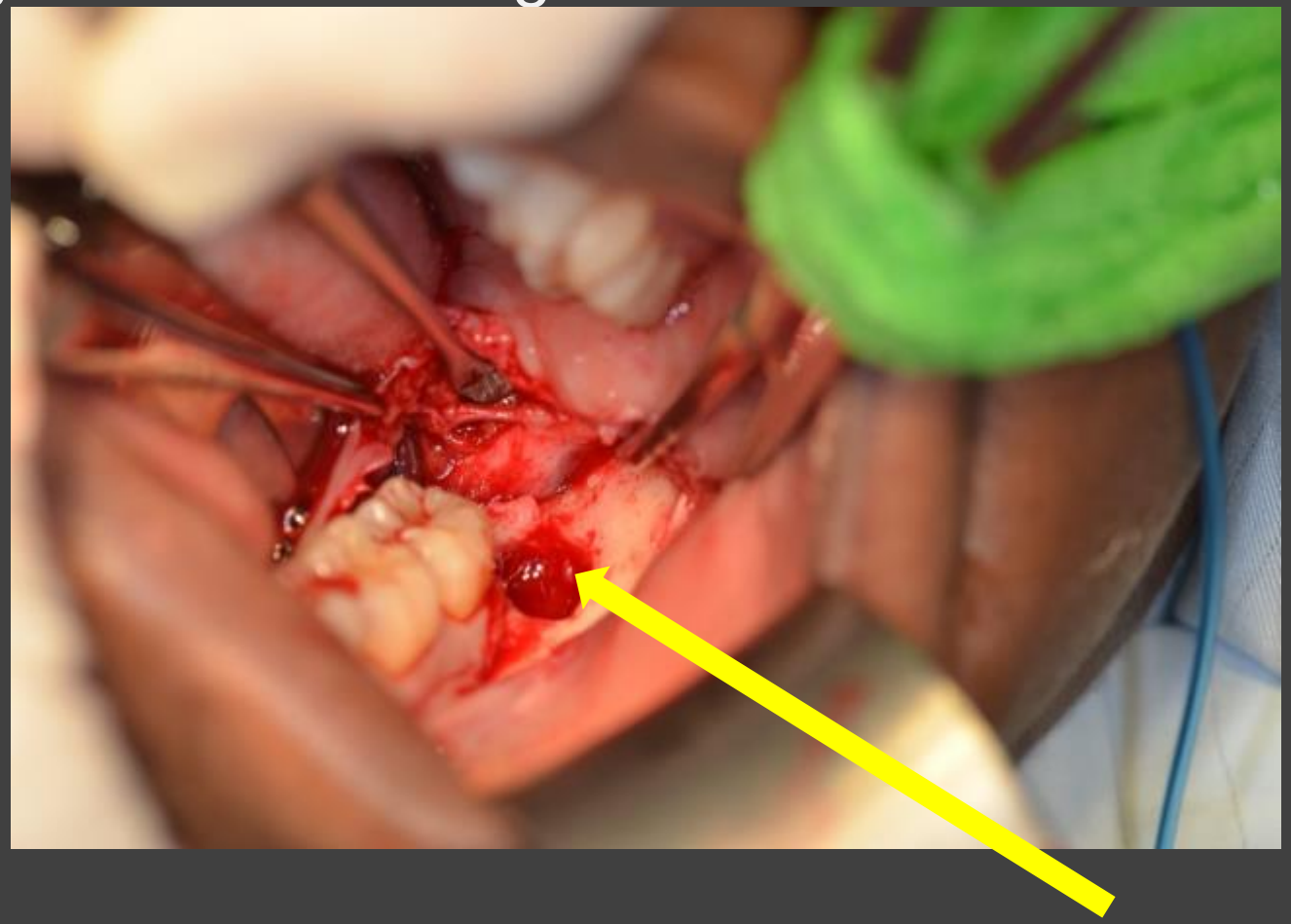
Prevention of nerve injury

Avoid distal bone removal
Spot the lingual nerve!



Prevention of nerve injury

Lingual nerve damage due to distal bone removal



Prevention of lingual nerve injury
The Buccal approach

The buccal approach

Is CBCT better than panoral in assessing risk?

- **Low positive predictive value of Panorex** in detecting patients at risk of IAN injuries after third molar extractions.
- Susarla et.al 2010: **CBCT examination could help in the treatment decision** and, probably in only a few of these cases, change the surgical procedure or even change the clinical decision- making process.
- **Data obtained from CBCT scan have a minimal effect on the final surgical outcome or morbidity**, and its routine use cannot be recommended. Better et al JOMS 2004: Garcia 2012
- **CBCT examinations per se do not seem to significantly decrease the prevalence of IAN injuries**. Dalili Z, Mahjoub P, Sigaroudi AK. Comparison between cone beam computed tomography and panoramic radiography in the assessment of the relationship between the mandibular canal and impacted cla[illegible]s C mandibular third molars. Dent Res J. 2011;8:203

Mixed opinions low evidence

What can a CBCT tell us?

- Volumetric CBCT critical radiographic findings as cortical perforation of the IAC resulting from the **intimate proximity** of M3 root(s).
- **Loss of the cortical line (interruption)** on the panoramic radiograph having a close correlation with proximity of the IAN to a M3 observed on a CBCT scan is 'highly suggestive of the risk of nerve injury.'
- **IDC's cortical perforation, as seen on a CBCT scan, can be closely correlated to darkening of the root** seen on a panoramic radiograph.
- The **risk of IAN injury increased** from the average of 1 to 5% to 20 to 30% when the **IAC cortical perforation** was observed.

Clinical Significance of Computed Tomographic Assessment and Anatomic Features of the Inferior Alveolar Canal as Risk Factors for Injury of the Inferior Alveolar Nerve at Third Molar Surgery: Ueda, Nakamori, Shiratori, Igarashi et.al Oral Maxillofac Surg 70:514-520, 2012 Assessment of the Shape of the Inferior Alveolar Canal as a Marker for Increased Risk of Injury to the Inferior Alveolar Nerve at Third Molar Surgery: Ueda, Nakamori, Shiratori, Igarashi et.al J Oral Maxillofac Surg 71:2012-2019, 2013