

CLINICAL PRACTICE GUIDELINES

December 2005

MOH/P/PAK/107.05 (GU)

MANAGEMENT OF UNERUPTED AND IMPACTED THIRD MOLAR TEETH



MINISTRY OF HEALTH MALAYSIA

Statement of Intent

This clinical practice guideline is meant to be a guide for clinical practice, based on the best available evidence at the time of development. Adherence to these guidelines may not necessarily ensure the best outcome in every case. Every health care provider is responsible for the management of his/her unique patient based on the clinical picture presented by the patient and the management options available locally.

Review of the Guidelines

This guideline was issued in December 2005 and will be reviewed if new evidence becomes available.

CPG Secretariat
Health Technology Assessment Unit
Medical Development Division
Ministry of Health Malaysia
Level 4, Block E1, Parcel E,
Government Office Complex,
62590, Putrajaya.

Available on the following website : <http://www.moh.gov.my>
<http://www.acadmed.org.my>

GUIDELINE DEVELOPMENT AND OBJECTIVES

RATIONALE FOR GUIDELINE DEVELOPMENT

Removal of symptomatic third molars is generally accepted. However, many controversies surround their prophylactic removal. This is because the surgical procedures for extraction of unerupted and impacted third molars are associated with significant morbidity while the benefits of such an operation on a pathology-free third molar have not been established. As a result, there is wide variation in the management of unerupted and impacted third molars among dental practitioners.

OBJECTIVE OF THE GUIDELINE

The objective of this guideline is to provide evidence-based recommendations for best practice in the management of unerupted and impacted third molars and to help achieve favourable outcomes as far as possible.

CLINICAL QUESTIONS

The clinical questions for these guidelines are:

- What are the diagnostic criteria of unerupted and impacted third molars?
- How are unerupted and impacted third molars managed?

TARGET POPULATION

These guidelines are to be applied to all patients presenting with unerupted and impacted third molars.

TARGET GROUP

These guidelines are developed for all oral health care professionals involved in the management of unerupted and impacted third molars.

METHODOLOGY

This guideline is formulated by adapting and updating the Management of Unerupted and Impacted Third Molar document published by the Scottish Intercollegiate Guidelines Network in September 1999. In addition, a systematic search was also carried out to look at evidence published from 1999 to 2005. The NICE technology appraisal (2004) and the Cochrane Systematic Review 2005 were also taken into consideration.

EVALUATION OF GUIDELINES

This draft guideline was also posted on the Ministry of Health Malaysia and Academy of Medicine Malaysia websites in order for the readers to forward feedbacks, opinions and contributions towards the improvement of the guideline.

MEMBERS OF THE PANEL

Dr Mohd Shah Abu Hassan

Senior Consultant Oral Surgeon & Head
Department of Oral Surgery
Ipoh Hospital

Chairperson

COMMITTEE MEMBERS (in alphabetical order)

Dr Maria Jerome Gere

Consultant Orthodontist
Cahaya Suria Dental Clinic
Kuala Lumpur

Dr Peace Indrani d/o Chelvanayagam

(Former) Consultant Oral Surgeon
Department of Oral Surgery
Tengku Ampuan Rahimah Hospital, Klang

Major Dr S Nagarajan

Paediatric Dental Specialist
Health Service Division
Military Armed Forces
Ministry of Defence

Dr Stephen Joseph Royan

Consultant Oral Surgeon
Department of Oral Surgery
Malacca Hospital

Datin Dr Nooral Zeila Junid

Principal Assistant Director
Oral Health Division
Ministry of Health Malaysia, Putrajaya

Dr Thomas Abraham

Consultant Oral Surgeon
Department of Oral Surgery
Tengku Ampuan Rahimah Hospital, Klang

Dr Kasmah Mohammad

Consultant Oral Surgeon
Department of Oral Surgery
Kuala Lumpur Hospital

Dr Yuen Kar Mun

Consultant Oral Surgeon
Department of Oral Surgery
Ipoh Hospital

Dr Kok Tuck Choon

Consultant Oral Surgeon
Department of Oral Surgery
Muar Hospital Johor

Coordinators :

Dr S Sivalal

(Former) Deputy Director
Health Technology Assessment Unit
Medical Development Division
Ministry of Health Malaysia

Dr Sheamini Sivasampu

Principal Assistant Director
Health Technology Assessment Unit
Medical Development Division
Ministry of Health Malaysia

Dr Rusilawati Jaudin

Principal Assistant Director
Health Technology Assessment Unit
Medical Development Division
Ministry of Health Malaysia

Ms Jeya Devi Coomarasamy

(Former) Senior Nursing Officer
Health Technology Assessment Unit
Medical Development Division
Ministry of Health Malaysia

EXTERNAL REVIEWERS

The draft guideline was also reviewed by a panel of external reviewers.

Prof Dr Ghazali bin Mat Nor	Consultant Oral Surgeon Department of Oral & Maxillofacial Surgery University Kebangsaan Malaysia Kuala Lumpur
Dr Jeyalan P.E Samanther	Private Dental Practitioner Dental Surgery Kepong Kuala Lumpur
Prof Ong Siew Tin	Consultant Oral Surgeon Department of Oral & Maxillofacial Surgery University Malaya Medical Centre Kuala Lumpur

SUMMARY OF RECOMMENDATIONS	GRADE OF RECOMMENDATIONS
Assessment of the unerupted and impacted third molar must involve history taking (including medical history), clinical examination and radiological investigations.	Grade C
Asymptomatic and pathology-free impacted third molars need not be removed but would advice periodic review.	Grade A
Impacted third molars should not be removed to prevent late anterior crowding.	Grade A
The main indications for removal of impacted third molars are dental caries and third molar associated infections.	Grade C
Proper case assessment and careful surgical technique can prevent unwanted complications.	Grade C
In third molar surgery, the buccal approach with minimal lingual soft tissue retraction minimizes the likelihood of lingual nerve injury.	Grade C
Excessive bone removal is not recommended.	Grade B
The routine use of antibiotics in third molar surgery is not recommended.	Grade A

Please refer to the inside of the back cover with regards to the grade of recommendations

TABLE OF CONTENTS

<i>Guideline Development and Objectives</i>	<i>i</i>
<i>Members of the Panel</i>	<i>ii</i>
<i>External Reviewers</i>	<i>iii</i>
<i>Summary of Recommendations</i>	<i>iv</i>
<i>Table of Contents</i>	<i>v</i>
1. Background	1
2. Diagnosis	1
2.1 Plain radiographs	1
2.2 Computed tomography (CT) scan	1
3. Management	2
3.1 Conservative management	2
3.2 Surgical management	2
<i>a. Indications for removal</i>	3
<i>b. Pre-operative assessment and management</i>	3
<i>c. Surgical procedure</i>	4
<i>d. Peri-operative drug therapy</i>	5
<i>e. Complications associated with surgery</i>	6
<i>f. Risk factors to develop post op complications</i>	7
4. References	10
Acknowledgements	15
Disclosure Statement	15
Sources of Funding	15

1. BACKGROUND

Third molars or wisdom teeth generally erupt between the ages of 18 and 24 years. However, sometimes they fail to erupt because they are either absent or impacted (SIGN 1999, ^{Level 9}). An impacted third molar tooth that fails to attain a functional position may cause infection, unrestorable caries, periodontal disease, cysts, or tumours (Song et al 2000, ^{Level 1}). The impacted third molar tooth can be managed conservatively, or alternatively, removed by surgical extraction, a common oral surgical procedure, which can be carried out by general dental practitioners or oral surgeons.

2. DIAGNOSIS

A detailed history must be taken, followed by clinical examination and radiological investigations.

2.1. Plain radiographs

A radiological evaluation provides information about the third molar and the surrounding structures. If there appears to be a relationship between the roots of the lower third molar and the inferior dental canal, a second radiograph using different projection geometry should be taken (SIGN 1999, ^{Level 9}).

The following are the radiographs of choice:

- ◆ intra-oral periapical view
- ◆ orthopantomogram
 - radiographic examination of choice when more than 1 of the third molar teeth requires to be assessed
- ◆ oblique lateral view of the mandible

2.2. Computed Tomography (CT) Scan

CT scan is indicated where there is a complex relationship between the third molar and the inferior dental canal. However, the benefits have to be weighed against the risks of high radiation exposure (Maegawa et al 2003, ^{Level 9}).

Recommendation for computed tomography (CT) scan

Assessment must involve history taking (including medical history), clinical examination and radiological investigations.

Grade C

3. MANAGEMENT

3.1 Conservative management

The removal of third molars is not indicated if they are asymptomatic and free of any pathology (Song et al 1997, ^{Level 1}), as long as good oral hygiene is maintained (Sasano et al 2003, ^{Level 6}). A recent systematic review demonstrated that there is no evidence to support or refute routine prophylactic removal of asymptomatic impacted wisdom tooth in adults (Mettes et al 2005, ^{Level 1}). The possible outcomes of surgery may be worse than that of non-treatment (Brickley et al 1995, ^{Level 8}; Liedholm et al 2000, ^{Level 6}), the risk of an impacted third molar developing pathology being small compared to the risks of surgical intervention (Hicks 1999, ^{Level 1}). Conservative treatment has also been found to be more cost-effective (Edwards et al 1999, ^{Level 6}).

Late anterior crowding related to impacted third molars cannot be accurately predicted (Hicks 1999, ^{Level 1}; Song et al 2000, ^{Level 1}) so that the removal of third molars to prevent crowding may not be justified (Harradine et al 1998, ^{Level 3}; Mettes et al 2005, ^{Level 1}). Conservative treatment is also advised for medically compromised patients when the risk to the patient's overall health outweighs the benefits of surgery (SIGN 1999, ^{Level 9}).

Recommendations for conservative management

Asymptomatic and pathology-free impacted third molars need not be removed but would advice periodic review.

Grade A

Impacted third molars should not be removed to prevent late anterior crowding.

Grade A

3.2 Surgical management

The surgical removal of impacted third molars is indicated in a few situations (SIGN 1999, ^{Level 9}). The decision to remove the impacted third molar must be made with due consideration to the patient's overall health status and the potential risk of complications. Pre-operative assessment should be carried out and informed consent obtained prior to surgery.

a. *Indications for removal are based on (SIGN 1999, ^{Level 9}) :*

- ♦ **Infection** – removal of any symptomatic wisdom tooth should be considered, especially where there have been one or more episodes of infection such as pericoronitis, cellulitis, abscess formation; or untreatable pulpal/periapical pathology. A first episode of pericoronitis, unless particularly severe, should not be considered an indication for surgery (NICE 2004, ^{Level 1})
- ♦ **Caries** – removal should be considered where there is caries in the third molar and the tooth is unlikely to be usefully restored, or when there is caries in the adjacent second molar tooth which cannot be satisfactorily treated without the removal of the third molar
- ♦ **Orthodontic consideration** – may be indicated prior to orthognathic surgery
- ♦ **Prosthetic consideration** – removal of partially erupted or unerupted third molar close to the alveolar surface should be considered prior to denture construction or implant placement
- ♦ **Other pathology** – third molars in relation to other pathology e.g. cysts, fractures, tumours may require removal.

Recommendation for indication for removal

The main indications for removal of impacted third molars are dental caries and third molar associated infections.

Grade C

b. *Pre-operative assessment and management*

Prior to surgery, any pericoronitis or other conditions associated with infection may be treated with systemic antibiotics, chlorhexidine mouth rinses (SIGN 1999, ^{Level 9}), local dressing and lavage.

The following radiographic signs have been associated with an increased risk of inferior dental nerve injury during third molar surgery:

- ♦ Diversion of the inferior dental canal
- ♦ Darkening of the root where crossed by the canal
- ♦ Interruption of the white lines of the canal
(SIGN 1999, ^{Level 9}; Blaeser et al 2003, ^{Level 7}; Bell 2004, ^{Level 8}).

The relationship or proximity of upper third molars to the maxillary antrum and the maxillary tuberosity should be assessed (SIGN 1999, ^{Level 9}).

The decision to treat surgically should be reviewed in the presence of any of the above signs.

Recommendation for pre-operative assessment and management

Proper case assessment and careful surgical technique can prevent unwanted complications.

Grade C

c. Surgical procedure

The surgical procedure generally involves raising of soft tissue flaps for exposure, removal of bone using either chisel or bur with water-cooled irrigation, delivering the whole tooth with or without prior division, and wound toilet.

The surgical procedure to be carried out depends on the following:

- ◆ status of the tooth
- ◆ type of impaction
- ◆ surrounding structures e.g. relationship of the inferior dental and lingual nerves

While the raising of tissue flaps is always associated with post-operative pain and trismus (Garcia 2000, ^{Level 8}), a smaller incision with minimal reflection will result in less pain and swelling (Shevel et al 2001, ^{Level 3}).

Removal of the impacted teeth through the buccal approach without lingual tissue retraction minimizes the risk of lingual nerve damage (Hagler & Reich 2002, ^{Level 9}). When the surgery is performed with lingual split technique together with lingual flap retraction, the incidence of lingual nerve injury appears to be even greater (Pichler & Beirne 2001, ^{Level 1}; Hagler & Reich 2002, ^{Level 9}). The placement of a periosteal elevator or lingual nerve retractor to protect the lingual tissue during surgical removal of impacted wisdom teeth appears to increase the incidence of lingual nerve damage (Robinson & Smith 1996, ^{Level 2}; Robinson et al 1999, ^{Level 5}; Valmaseda et al 2000, ^{Level 5}; Gargallo et al 2000, ^{Level 4}; Pichler & Beirne 2001, ^{Level 1}; Hagler & Reich 2002, ^{Level 9}). However, lingual nerve injury associated with lingual flap retraction is found to be temporary (Pichler & Beirne 2001, ^{Level 1}).

There is conflicting evidence as to the most appropriate form of protection for the lingual nerve (SIGN 1999, ^{Level 9}). Generally, minimal interference to the lingual soft tissue is associated with a low incidence of lingual nerve injury (Malden & Maidment 2002, ^{Level 8}). Retention of the lingual plate gives optimum protection to the lingual nerve during

removal of impacted third molar teeth (Appiah-Anane S & Appiah-Anane MG 1997, ^{Level 5}).

Exposure or intra-operative opening of the mandibular canal during surgery greatly increases the incidence of inferior alveolar nerve paraesthesia (Gulicher & Gerlach 2000, ^{Level 5}; Gulicher & Gerlach 2001, ^{Level 4}; Tay & Go 2004, ^{Level 4}).

Excessive removal of bone and vertical sectioning of the impacted teeth may lead to inferior alveolar nerve injury (Miura et al 1998, ^{Level 5}).

Any suspicious pathological material should be sent for histopathological examination. Occasionally, a small fragment of the apical root of a vital tooth may be left behind if its removal carries a greater risk of complications than retention. In these situations, the patient should be informed and a record made in the case notes (SIGN 1999, ^{Level 9}).

Other procedures include Operculectomy is a procedure which can be considered in carefully selected cases with the proviso that subsequent removal of the tooth may be required. Surgical exposure or surgical reimplantation/transplantation may be appropriate treatment in selected cases (SIGN 1999, ^{Level 9}; Sobhi et al 2003, ^{Level 8}; Mejare et al 2004, ^{Level 8}).

Recommendations for surgical procedure

In third molar surgery, the buccal approach with minimal lingual soft tissue retraction minimizes the likelihood of lingual nerve injury.

Grade C

Excessive bone removal is not recommended.

Grade B

d. Peri-operative drug therapy

Antibiotics

Antibiotic prescription may be considered in the following situations (SIGN 1999, ^{Level 9}; Delilbasi 2002, ^{Level 3}) :

- ◆ presence of acute infection at the time of operation
- ◆ significant bone removal
- ◆ prolonged operation time
- ◆ patient is at increased risk of infection

However, the routine use of antibiotics in third molar removal is not recommended (SIGN 1999, ^{Level 9}; Bulut et al 2001, ^{Level 5}; Sekhar, Narayanan & Baig 2001, ^{Level 2}; Poeschl et al 2004, ^{Level 2}).

Recommendation for peri-operative drug therapy

The routine use of antibiotics in third molar surgery is not advised.

Grade A

Analgesics

Oral analgesics such as paracetamol or ibuprofen are commonly prescribed for outpatients. NSAIDs or opiates are commonly prescribed for inpatients. NSAIDs may also be helpful in reducing post-operative swelling (Bjornsson 2003, ^{Level 3}).

Steroids

Where there is a risk of significant post-operative swelling, pre- or peri-operative administration of dexamethasone or methyl prednisolone has been shown to reduce swelling and discomfort (SIGN 1999, ^{Level 9}).

e. Complications associated with surgery

- The complication rate of third molar surgery ranges from 9.1% to 12.6% (Muhonen et al 1997, ^{Level 6}; Schoen et al 1998, ^{Level 6}; Christiaens & Reyckler 2002, ^{Level 6}). The most common complications are as follows:
 - ◆ Dry Socket /Alveolar Osteitis (0.3% - 35%)
 - ◆ Wound infection /post-operative infection (1% - 16%)
 - ◆ Post-operative bleeding (1.5%)
 - ◆ Lingual and inferior alveolar nerve injuries
 - transient disturbances of the inferior alveolar nerve (0.4-0.6%)
 - transient disturbances of the lingual nerve (0.06-11.5%)
 - permanent nerve disturbances (0.2-1%) (Strietzel & Reichart 2002, ^{Level 1}; Muhonen et al 1997, ^{Level 6}).
- When only nerve injuries are considered, the incidence of inferior alveolar injury is between 0.6-20.3% (Black 1997, ^{Level 4}; Miura et al 1998, ^{Level 5}; Gulicher & Gerlach 2000, ^{Level 5}; Gulicher & Gerlach 2001, ^{Level 4}; Rehman et al 2002, ^{Level 5}; Tay & Go 2004, ^{Level 4}), and lingual nerve injury 0.05-6.9% (Robinson & Smith 1996, ^{Level 2}; Chiapasco et al 1996, ^{Level 6}; Robinson 1999, ^{Level 5}; Gargallo 2000, ^{Level 4}; Gulicher &

Gerlach 2000, ^{Level 5}, Gulicher & Gerlach 2001, ^{Level 4}; Rehman 2002, ^{Level 5}). Most of these nerve injuries are transient in nature.

Oro-antral communication and fracture of maxillary tuberosity are possible complications associated with upper third molar removal (SIGN 1999, ^{Level 9})

Pain, swelling and trismus are common post-operative features of third molar surgery, with maximum pain about 6 hours after surgery (Penarrocha et al 2001, ^{Level 4}). These complications can cause significant deterioration in quality of life of the patient for the first 4-5 post-surgical days (McGrath et al 2003, ^{Level 6}; Schoen et al 1998, ^{Level 6}).

Another less common complication is periodontal pocketing, which occurs distal to the second mandibular molar, especially when there is an existing periodontal pocket prior to surgery, or when there is poor post-surgical local plaque control. The impacted tooth is mesioangularly placed, with pre-surgical crestal radiolucency seen in radiographs (Kan et al 2002, ^{Level 6}).

Subluxation of adjacent periodontally involved molar may take place if excessive force is used on elevating the involved impacted molar.

Fracture of mandible is a rare complication with an incidence of 0.0049% (Libersa et al 2002, ^{Level 6}). The fracture usually occurs within the first week after surgery.

Other severe, rare and unexpected complications can also occur following third molar surgery due to poor clinical case assessment or due to careless and unorthodox clinical practices.

f. Risk factors to develop post op complications

The following risk factors have been shown to influence the occurrence of post-operative complications following third molar surgery :

◆ **Age**

Patients above 25 years of age show significant increase in post-operative complications (Chiapasco et al 1995, ^{Level 5}; Muhonen 1997, ^{Level 6}; Yoshii et al 2001, ^{Level 6}; Christiaens & Reyckler 2002, ^{Level 6}; Strietzel & Reichart 2002, ^{Level 1}; Phillips et al 2003, ^{Level 6}; Bui

2003, ^{Level 6}) especially in relation to nerve injuries (Gulich & Gerlach 2000, ^{Level 5}; Gulich & Gerlach 2001, ^{Level 4}; Miura et al 1998, ^{Level 5}; Black 1997, ^{Level 4}).

Older patients tend to report more intense post-operative pain (Olmedo 2002, ^{Level 4}) and are at higher risk of extended operation time (Benediktsdottir et al 2004, ^{Level 6}).

◆ **Gender**

Female patients appear to be more prone to post-operative complications such as pain and dry socket (Phillips et al 2003, ^{Level 6}; Benediktsdottir et al 2004, ^{Level 6}) especially women on oral contraceptives (Muhonen 1997, ^{Level 6}; Garcia et al 2003, ^{Level 6}).

◆ **Pre-existing pathology**

There is a significant increase in post-operative complications if there are signs of pericoronal inflammation or infection of the impacted teeth prior to surgery (de Boer et al 1995, ^{Level 6}; Phillips et al 2003, ^{Level 6}).

◆ **Depth of impaction and position**

Deeply embedded teeth that require removal of bone show higher incidence of post-operative complications (Muhonen 1997, ^{Level 6}; Christiaens & Reychler 2002, ^{Level 6}; Strietzel & Reichart 2002, ^{Level 1}). The position of the impacted teeth relative to the inferior dental nerve has a significant influence on the post-surgical nerve Dysaesthesia or Paraesthesia (Gulich & Gerlach 2000, ^{Level 5}; Gulich & Gerlach 2001, ^{Level 4}; Bui et al 2003, ^{Level 6}), lingual nerve Dysaesthesia being greater when the impacted teeth are lingually angulated (Valmaseda 2000, ^{Level 5}).

◆ **Oral hygiene**

Patients with poor oral hygiene pre-operatively have higher pain level post-operatively (Penarrocha et al 2001, ^{Level 6}).

◆ **Choice of Anaesthesia**

Local anaesthesia carries less risk (SIGN 1999, ^{Level 9}) and is associated with less patient stress (Hill et al 2001, ^{Level 5}). The post-operative complication rate following third molar surgery ranges from 8.2% (general anaesthesia) to 12.6% (local anaesthesia)

(Christiaens & Reychler 2002, ^{Level 6}). While removal of third molar under general anaesthesia shows greater incidence of nerve injury (Hill et al 2001, ^{Level 5}; Brann 1999, ^{Level 4}), no link has been established between the choice of anaesthesia and nerve damage during lower third molar removal (Hill et al 2001, ^{Level 5}; Rehman 2002, ^{Level 5}). The incidence of lingual dysesthesia is greater when the surgery is performed under general anaesthesia (Gulicher & Gerlach 2000, ^{Level 5}; Gulicher & Gerlach 2001, ^{Level 4}).

◆ **Experience of the operator**

Experienced surgeons are able to predict the difficulty of surgery and the factors that could delay post-operative recovery (Phillips et al 2003, ^{Level 6}).

REFERENCES

- Appiah-Anane S, Appiah-Anane MG (1997). Protection of the lingual nerve during operations on the mandibular third molar: a simple method *Br J Oral Maxillofac Surg.* Jun;35(3):170-2
- Bell GW (2004). Use of dental panoramic tomographs to predict the relation between mandibular third molar teeth and the inferior alveolar nerve. Radiological and surgical findings, and clinical outcome. *Br J Oral Maxillofac Surg.* Feb;42(1):21-7.
- Benediktsdottir IS, Wenzel A, Petersen JK, Hintze H (2004). Mandibular third molar removal: risk indicators for extended operation time, postoperative pain, and complications. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Apr;97(4):438-46
- Bjornsson GA, Haanaes HR, Skoglund LA (2003). Naproxen 500 mg bid versus acetaminophen 1000 mg qid: effect on swelling and other acute postoperative events after bilateral third molar surgery. *J Clin Pharmacol.* Aug;43(8):849-58.
- Black CG (1997). Sensory impairment following lower third molar surgery: a prospective study in New Zealand. *N Z Dent J.* Sep;93(413):68-71
- Blaeser BF, August MA, Donoff RB, Kaban LB, Dodson TB (2003). Panoramic radiographic risk factors for inferior alveolar nerve injury after third molar extraction. *J Oral Maxillofac Surg.* Apr;61(4):417-21.
- Brann CR, Brickley MR, Shepherd JP (1999). Factors influencing nerve damage during lower third molar surgery. *Br Dent J.* May 22;186(10):514-6
- Brickley M, Kay E, Shepherd JP, Armstrong RA (1995). Decision analysis for lower-third-molar surgery. *Med Decis Making.* Apr-Jun;15(2):143-51
- Bui CH, Seldin EB, Dodson TB (2003). Types, frequencies, and risk factors for complications after third molar extraction. *J Oral Maxillofac Surg.* Dec;61(12):1379-89
- Bulut E, Bulut S, Etikan I, Koseoglu O (2001). The value of routine antibiotic prophylaxis in mandibular third molar surgery: acute-phase protein levels as indicators of infection. *J Oral Sci.* Jun;43(2):117-22.
- Chiapasco M, Crescentini M, Romanoni G (1995). Germectomy or delayed removal of mandibular impacted third molars: the relationship between age and incidence of complications. *J Oral Maxillofac Surg.* Apr;53(4):418-22; discussion 422-423
- Chiapasco M, Pedrinazzi M, Motta J, Crescentini M, Ramundo G (1996). Surgery of lower third molars and lesions of the lingual nerve. *Minerva Stomatol.* Nov;45(11):517-22
- Christiaens I, Reychler H. Complications after third molar extractions: retrospective analysis of 1,213 teeth (2002). *Rev Stomatol Chir Maxillofac.* Nov;103(5):269-74

de Boer MP, Raghoobar GM, Stegenga B, Schoen PJ, Boering G (1995). Complications after mandibular third molar extraction. *Quintessence Int*, Nov;26(11):779-84

Delilbasi C, Saracoglu U, Keskin A (2002). Effects of 0.2% chlorhexidine gluconate and amoxicillin plus clavulanic acid on the prevention of alveolar osteitis following mandibular third molar extractions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. Sep;94(3):301-4.

Edwards DJ, Horton J, Shepherd JP, Brickley MR (1999). Impact of third molar removal on demands for postoperative care and job disruption: does anaesthetic choice make a difference? *Ann R Coll Surg Engl*. Mar;81(2):119-23

Garcia AG, Sampedro FG, Rey JG, Vila PG, Martin MS (2000). Pell-Gregory classification is unreliable as a predictor of difficulty in extracting impacted lower third molars. *Br J Oral Maxillofac Surg* Dec;38(6):585-587.

Garcia AG, Grana PM, Sampedro FG, Diago MP, Rey JM (2003). Does oral contraceptive use affect the incidence of complications after extraction of a mandibular third molar? *Br Dent J*. Apr 26;194(8):453-5; discussion 445

Gargallo-Albiol J, Buenechea-Imaz R, Gay-Escoda C (2000). Lingual nerve protection during surgical removal of lower third molars. a prospective randomised study. *Int J Oral Maxillofac Surg*. Aug;29(4):268-71

Gulicher D, Gerlach KL (2000). Incidence, risk factors and follow-up of sensation disorders after surgical wisdom tooth removal. Study of 1,106 cases. *Mund Kiefer Gesichtschir*. Mar;4(2):99-104

Gulicher D, Gerlach KL (2001). Sensory impairment of the lingual and inferior alveolar nerves following removal of impacted mandibular third molars. *Int J Oral Maxillofac Surg*. Aug;30(4):306-12

Hagler G, Reich RH (2002). Risk and prevention of lesions of the lingual nerve in wisdom tooth osteotomy. Analysis of the literature and faculty opinion in maxillofacial surgery in German-speaking countries. *Mund Kiefer Gesichtschir*. Jan;6(1):34-9

Harradine NW, Pearson MH, Toth B (1998). The effect of extraction of third molars on late lower incisor crowding: a randomized controlled trial. *Br J Orthod*. May;25(2):117-22.

Hicks EP (1999). Third molar management: a case against routine removal in adolescent and young adult orthodontic patients. *J Oral Maxillofac Surg*. Jul;57(7):831-6.

Hill CM, Mostafa P, Thomas DW, Newcombe RG, Walker RV (2001). Nerve morbidity following wisdom tooth removal under local and general anaesthesia. *Br J Oral Maxillofac Surg*. Dec;39(6):419-22

Kan KW, Liu JK, Lo EC, Corbet EF, Leung WK (2002). Residual periodontal defects distal to the mandibular second molar 6-36 months after impacted third molar extraction. *J Clin Periodontol.* Nov;29(11):1004-1011

Libersa P, Roze D, Cachart T, Libersa JC (2002). Immediate and late mandibular fractures after third molar removal. *J Oral Maxillofac Surg* Feb;60(2):163-5; discussion 165-166

Liedholm R, Knutsson K, Lysell L, Rohlin M, Brickley M, Shepherd JP (2000). The outcomes of mandibular third molar removal and non-removal: a study of patients' preferences using a multi-attribute method *Acta Odontol Scand.* Dec;58(6):293-298.

Maegawa H, Sano K, Kitagawa Y, Ogasawara T, Miyauchi K, Sekine J, Inokuchi T (2003). Preoperative assessment of the relationship between the mandibular third molar and the mandibular canal by axial computed tomography with coronal and sagittal reconstruction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Nov;96(5):639-646.

Malden NJ, Maidment YG (2002). Lingual nerve injury subsequent to wisdom teeth removal—a 5-year retrospective audit from a high street dental practice. *Br Dent J.* Aug 24;193(4):203-205

McGrath C, Comfort MB, Lo EC, Luo Y (2003). Changes in life quality following third molar surgery—the immediate postoperative period. *Br Dent J.* Mar 8;194(5):265-8; discussion 261

Mejare B, Wannfors K, Jansson L (2004). A prospective study on transplantation of third molars with complete root formation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Feb;97(2):231-8.

Mettes TG, Nienhuijs MEL, van der Sanden WJM, Verdonshot EH, Plasschaert AJM (2005). Interventions for treating asymptomatic impacted wisdom teeth in adolescents and adult. *Cochrane Systematic Review.* CD003879

Miura K, Kino K, Shibuya T, Hirata Y, Shibuya T, Sasaki E, Komiyama T, Yoshimasu H, Amagasa T (1998). Nerve paralysis after third molar extraction. *Kokubyo Gakkai Zasshi.* Mar;65(1):1-5

Muhonen A, Venta I, Ylipaavalniemi P (1997). Factors predisposing to postoperative complications related to wisdom tooth surgery among university students. *J Am Coll Health.* Jul;46(1):39-42

NICE (2004). Guidance on the extraction of wisdom teeth. *Technology Appraisal No1*

Olmedo-Gaya MV, Vallecillo-Capilla M, Galvez-Mateos R (2002). Relation of patient and surgical variables to postoperative pain and inflammation in the extraction of third molars. *Med Oral.* Nov-Dec;7(5):360-369.

Pajarola G, Riva C, Good M, Gratz KW (2003). Pain management after third molar extraction. Observations of the use of mefenamic acid and rofecoxib in the treatment of postoperative pain in the dental office. *Schweiz Monatsschr Zahnmed.*;113(8):887-896.

Penarrocha M, Sanchis JM, Saez U, Gay C, Bagan JV (2001). Oral hygiene and postoperative pain after mandibular third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Sep;92(3):260-264

Phillips C, White RP Jr, Shugars DA, Zhou X (2003). Risk factors associated with prolonged recovery and delayed healing after third molar surgery. *J Oral Maxillofac Surg.* Dec;61(12):1436-1448

Pichler JW, Beirne OR (2001). Lingual flap retraction and prevention of lingual nerve damage associated with third molar surgery: a systematic review of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Apr;91(4):395-401

Poeschl PW, Eckel D, Poeschl E (2004). Postoperative prophylactic antibiotic treatment in third molar surgery—a necessity? *J Oral Maxillofac Surg.* Jan;62(1):3-8; discussion 9.

Rehman K, Webster K, Dover MS (2002). Links between anaesthetic modality and nerve damage during lower third molar surgery. *Br Dent J.* Jul 13;193(1):43-45

Robinson PP, Loescher AR, Smith KG (1999). The effect of surgical technique on lingual nerve damage during lower 3rd molar removal by dental students. *Eur J Dent Educ.* May;3(2):52-55

Robinson PP, Smith KG (1996). Lingual nerve damage during lower third molar removal: a comparison of two surgical methods. *Br Dent J.* Jun 22;180(12):456-461

Sasano T, Kuribara N, Iikubo M, Yoshida A, Satoh-Kuiriwada S, Shoji N, Sakamoto M (2003). Influence of angular position and degree of impaction of third molars on development of symptoms: long-term follow-up under good oral hygiene conditions. *Tohoku J Exp Med.* Jun;200(2):75-83

Schoen PJ, Hulshoff AC, Raghoobar GM, Stegenga B, de Bont LG (1998). Complaints and complications associated with removal of the mandibular third molar. A prospective clinical study. *Ned Tijdschr Tandheelkd.* May;105(5):170-173

Sekhar CH, Narayanan V, Baig MF (2001). Role of antimicrobials in third molar surgery: prospective, double blind, randomized, placebo-controlled clinical study. *Br J Oral Maxillofac Surg.* Apr;39(2):134-137.

Shevel E, Koeppe WG, Butow KW (2001). A subjective assessment of pain and swelling following the surgical removal of impacted third molar teeth using different surgical techniques. *SADJ.* May;56(5):238-241.

SIGN (1999). Management of the unerupted and impacted third molar teeth.

Sobhi MB, Rana MJ, Manzoor MA, Ibrahim M, Tasleem-ul-Hudda (2003). Autotransplantation of endodontically treated third molars. *J Coll Physicians Surg Pak.* Jul;13(7):372-374.

Song F, O'Meara S, Wilson P, Golder S, Kleijnen J (2000). The effectiveness and cost-effectiveness of prophylactic removal of wisdom teeth. *Health Technol Assess.*;4(15):1-55

Song F, Landes DP, Glenny AM, Sheldon TA. Prophylactic removal of impacted third molars: an assessment of published reviews *Br Dent J.* (1997) May 10;182(9):339-46.

Strietzel FP, Reichart PA (2002). Wound healing after surgical wisdom tooth extraction. Evidence-based analysis. *Mund Kiefer Gesichtschir.* Mar;6(2):74-84

Tay AB, Go WS (2004). Effect of exposed inferior alveolar neurovascular bundle during surgical removal of impacted lower third molars. *J Oral Maxillofac Surg.* May;62(5):592-600

Valmaseda-Castellon E, Berini-Aytes L, Gay-Escoda C (2000). Lingual nerve damage after third lower molar surgical extraction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Nov;90(5):567-73

Yoshii T, Hamamoto Y, Muraoka S, Kohjitani A, Teranobu O, Furudo S, Komori T (2001). Incidence of deep fascial space infection after surgical removal of the mandibular third molars. *J Infect Chemother.* Mar;7(1):55-7

ACKNOWLEDGEMENTS

The committee of this guideline would like to express their gratitude and appreciation to the following for their contribution:

- Panel of external reviewers who reviewed the draft.
- Dr Asma Mohamad, Dr Fauziah Ahmad and Dr Salleh Zakaria who reviewed the draft CPG.
- Technical Advisory Committee for Clinical Practice Guidelines for their valuable input and feedback.
- CPG Secretariat, particularly Datin Dr Rugayah Bakri, Head of Health Technology Assessment Unit, and Ms Hanita Muhsin, Nursing Manager, Medical Development Division, Ministry of Health Malaysia.

DISCLOSURE STATEMENT

The panel members have no potential conflict of interest to disclose.

SOURCES OF FUNDING

The development of the CPG on Management of Unerupted and Impacted Third Molar Teeth was supported financially in its entirety by the Ministry of Health Malaysia and was developed without any involvement of the pharmaceutical industry.

LEVELS OF EVIDENCE SCALE

Level	Strength of Evidence	Study Design
1	Good	Meta-analysis of RCT, Systematic review
2	Good	Large sample RCT
3	Good to Fair	Small sample RCT
4	Good to Fair	Non-randomised controlled prospective trial
5	Fair	Non-randomised controlled prospective trial with historical control
6	Fair	Cohort studies
7	Poor	Case-control studies
8	Poor	Non-controlled clinical series, descriptive studies multi-centre
9	Poor	Expert committees, consensus, case reports anecdotes

Adapted from Catalonian Agency for Health Technology Assessment & Research, (CAHTAR) Spain

GRADES OF RECOMMENDATIONS

A	At least one meta analysis, systematic review, or RCT, or evidence rated as good and directly applicable to the target population
B	Evidence from well conducted clinical trials, directly applicable to the target population, and demonstrating overall consistency of results; or evidence extrapolated from meta analysis, systematic review, or RCT
C	Evidence from expert committee reports, or opinions and /or clinical experiences of respected authorities; indicates absence of directly applicable clinical studies of good quality