



Oral Health Division

**MANAGEMENT OF
ACUTE OROFACIAL INFECTION OF
ODONTOGENIC ORIGIN IN CHILDREN
(1st Edition)**



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STATEMENT OF INTENT

These clinical practice guidelines (CPG) are meant to be a guide for clinical practice, and are based on the best available evidence at the time of development. Adherence to these guidelines may not necessarily lead to the best clinical outcome in an individual patient care. Every healthcare provider is responsible for the management of their individual patient based on the clinical presentation and management options that are available locally.

REVIEW OF THE GUIDELINES

These guidelines were issued in December 2016 and will be in December 2021 or earlier if new evidence becomes available.

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LEVELS OF EVIDENCE

LEVEL	STUDY DESIGN
I	Evidence obtained from at least one properly designed randomised controlled trial.
II-1	Evidence obtained from well-designed controlled trials without randomisation.
II-2	Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one centre or research group.
II-3	Evidence obtained from multiple time series studies, with or without intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence.
III	Opinions or respected authorities, based on clinical experience; descriptive studies and case reports; or reports of expert committees.

Source: Adapted from Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, Teutsch SM, Atkins D. Current Methods of the U.S. Preventive Services Task Force: A Review of the Process. Am J Prev Med. 2001;20(suppl 3):21-35.

GRADES OF RECOMMENDATION

GRADE	STUDY DESIGN
A	At least one meta-analysis, systematic review or RCT or evidence rated as good or 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 reviews 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.

Source: Modified from the Scottish Intercollegiate Guidelines Network (SIGN 50). A guideline developer's handbook. Elliott House, 8 -10 Hillside Crescent Edinburgh EH7 5EA. Revised November 2011. ISBN 978 1 905813 25 4.

Note: The grades of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.

GUIDELINES DEVELOPMENT AND OBJECTIVES

GUIDELINES DEVELOPMENT

The Development Group for these Clinical Practice Guidelines (CPG) consisted of Paediatric Dental Specialists, a Clinical Microbiologist, Dental Public Health Specialists, a general dental practitioner and a dental nurse. A Review Committee was actively involved in the development process of these guidelines.

Literature search was carried out using the following electronic databases: PUBMED/MEDLINE; Cochrane Database of Systemic Reviews (CDSR); ISI Web of Knowledge; Health Technology Assessment (HTA) and full text journal articles via Ovid search engine. The reference lists of all relevant articles retrieved were also examined to identify pertinent information that may be significant for further studies. Free text terms or MeSH terms were used either singly or in combination to retrieve the articles (**Appendix 1**). Only literature written in English was retrieved.

There were 7 clinical questions assigned to members of the development group. The group members met for a total of eight times during throughout the development of the guidelines. Relevant literatures retrieved were appraised by at least two members and presented in the form of evidence table and discussed during the group meetings. All statements and recommendations formulated were agreed upon by both the development group and review committee. These CPG are based on scientific evidences and adapted according to local practices. However, where there was a lack of evidence, recommendations were based on consensus of group members. Ideally patients' views and preferences were also needed to be considered in the development of CPGs, however in this particular instance, it was not feasible. Nevertheless, patient information leaflets is also considered in the attempt would be developed to facilitate the dissemination of important information to the public in the future.

The levels of evidence of the literature were graded using a the modified version adapted from the United States (U.S) / Canadian Preventive Services Task Force, while the grading of recommendations was based on the a modified version of the Scottish Intercollegiate Guidelines Network (SIGN).

The draft guidelines were reviewed by a team of external reviewers and were also posted on the Ministry of Health, Malaysia and Academy of Medicine, Malaysia websites for comments and

feedbacks. These guidelines were presented to the Technical Advisory Committee for CPGs, and finally to the HTA and CPG Council, Ministry of Health, Malaysia for approval.

OBJECTIVE

The main aim of the guidelines is to enable practitioners to make informed decisions for individual patients in the detection and management of acute orofacial infection of odontogenic origin in children.

SPECIFIC OBJECTIVES

1. To disseminate and reinforce knowledge on acute orofacial infection of odontogenic origin in children among healthcare professionals.
2. To provide timely and appropriate management procedure of acute orofacial infection of odontogenic origin (AOI) in children by for healthcare professionals.

CLINICAL QUESTIONS

The clinical questions addressed by these guidelines are found in **Appendix 2**.

TARGET POPULATION

These guidelines will be useful when assessing all children below the age of 16 years who present with signs and symptoms of acute orofacial infection of odontogenic origin.

TARGET GROUP/USER

These guidelines are applicable for all healthcare professionals who are involved in the management of AOI in children which includes: dental officers, medical officers, general practitioners (dental and medical), dental and medical students, paediatric dental specialists, and relevant medical specialists (such as ophthalmology, otorhinolaryngology, and paediatrics).

HEALTHCARE SETTINGS

Primary and Specialist Health care settings at public and private sectors.

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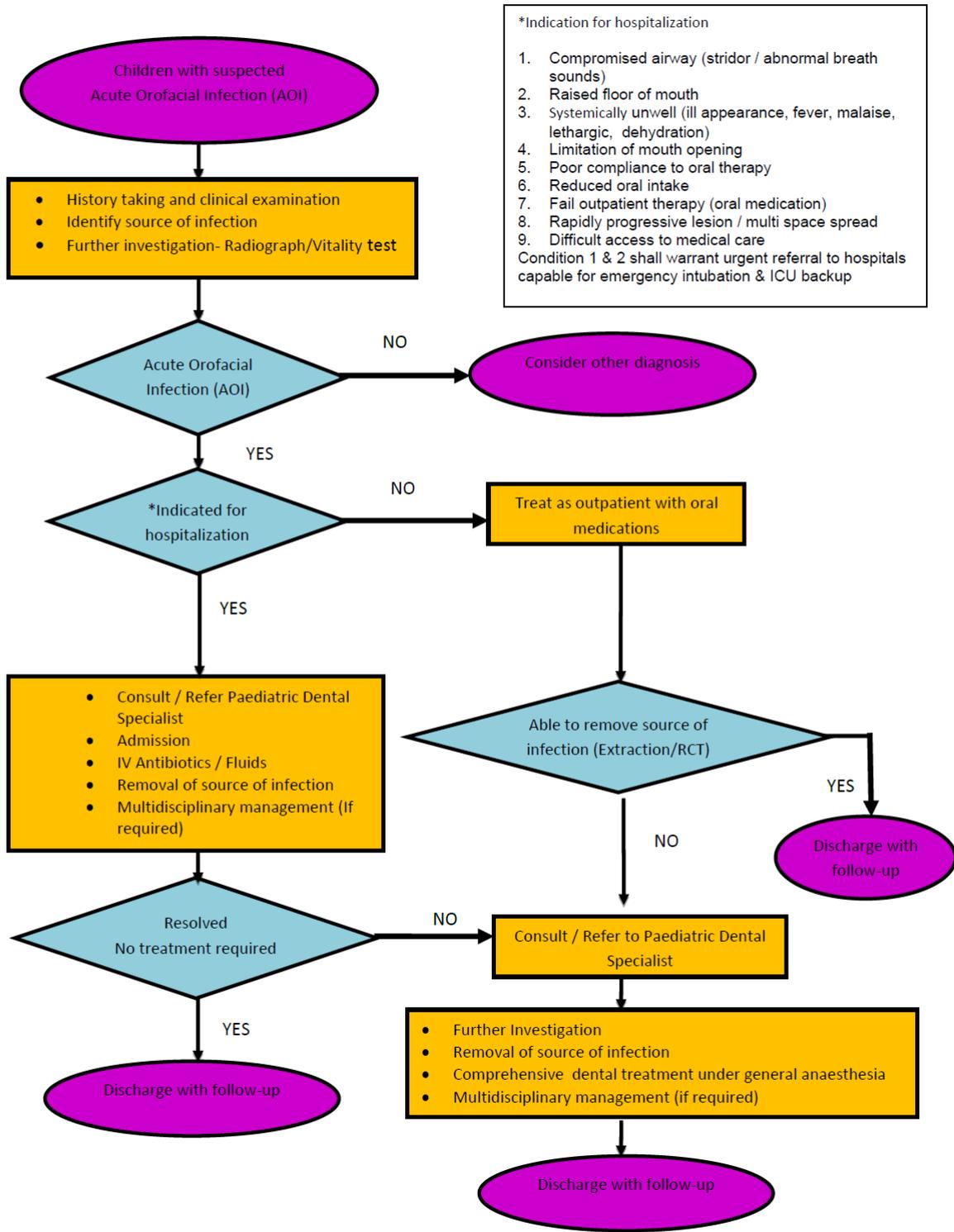
MEMBERS OF THE REVIEW COMMITTEE

A panel of independent reviewers, both locally and internationally, reviewed these guidelines. They were asked to comment primarily on the comprehensiveness and accuracy of the interpretation of the evidence that supports the recommendations put forth in the guideline. The following internal and external reviewers provided comments and feedbacks on the proposed draft:

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ALGORITHM: MANAGEMENT OF ACUTE OROFACIAL INFECTION OF ODONTOGENIC

ORIGIN IN CHILDREN



1. INTRODUCTION

Odontogenic infections are among the most common infections of oral cavity. The causes of odontogenic infections are dental pulp necrosis secondary to dental caries, deep dental restorations, or dental trauma.^{1, level III} They progress through 3 stages: inoculation, cellulitis and abscess.^{2, level III} Odontogenic infections are usually localised however in acute orofacial infection stage, the infection can spread rapidly ranging from mild buccal space infection to a severe life-threatening multi – space infection.

Early diagnosis and treatment are critical as paediatric patients with facial infection become dehydrated and systemically ill very rapidly.^{3, level III} The management of these conditions in children poses greater challenges to the clinician as there maybe problems with behaviour management making examination, investigations and treatment difficult. Children may also deteriorate faster due to the differences in physiology and anatomy as compared to adults. Hence, a delay in treatment, especially due to ignorance by carers, or even poor access to hospital care and / or lack of sound diagnostic skills by clinicians will further complicate its management. Furthermore, uncertainty in the management of any of such conditions by the clinicians at the primary care level, will additionally pose serious risk of morbidity and mortality among these paediatric patients. At present, there is no local clinical practice guideline available on this topic and anecdotal observations conducted have shown that health care providers sometimes face difficulty in making appropriate clinical judgements and there are variations of clinical practice.

2. EPIDEMIOLOGY

AOI is a common encounter in all dental clinics in Malaysia and affects both dentate children and adults. There is variation in the prevalence of odontogenic related infection that have been reported in the literature. For instance, a local study in Raja Perempuan Zainab II Hospital, Kota Bharu, has documented a total of 41 cases over a period of 2 years with a prevalence of 2%. while Kaosiung Chang Gung Children Hospital, Taiwan,

reported 56 cases in a year.^{4, level III, 5, level III} In contrast, a report from an urban hospital in America reported 63 cases over 6 years.^{6, level III}

3. CLINICAL PRESENTATION

A child with AOI commonly presents with an acute inflammatory process called cellulitis and this represents the initial acute phase of the infection. The features of cellulitis are red, warm, tender area of skin often with diffuse swelling. In its early stage, cellulitis feels soft and doughy to palpation whereas in its advanced and serious form, it is firm, indurated and painful because of tissue distension.^{7, level III} The patient might also present with a history of toothache and fever preceding the swelling.^{3,5, level III} Upon oral examination there may exist swelling of the buccal sulcus. If the infection is found to be that of odontogenic origin there is usually evidence of tooth or teeth with extensive caries, mobility, fracture, or tenderness to percussion.^{8, level III}

When the infection is mild (**Figure 1**), the child's body temperature may be below 38°C without significant trismus, swelling or pain.^{3,9, level III} Patients with moderate to severe infections will feel ill and lethargic (malaise). They generally present with an increased heart and respiratory rate, and a temperature greater than 38°C.^{7, level III} They often complain of the inability to eat and/or drink. The patient will also present with a large swelling, marked trismus, and moderate to severe pain and may find it difficult to speak and swallow (**Figure 2**). Oedema of the floor of the mouth and decreased tongue mobility may also be seen clinically. Involvement of multiple adjacent anatomic spaces might be observed.^{2,9, level III} There may be signs of local spread to regional lymph nodes and progression to abscess formation. When abscess formation begins, the swelling will be more localized, fluctuant and tender on palpation, along with red periphery and pus formation.^{2,10, level III}

Figure 1 : Mild AOI**Figure 2 : Severe AOI**

AOI can spread from the mandible into sublingual, submandibular, buccal, peritonsillar or parapharyngeal spaces whereas infection from the maxilla may spread into periorbital and infratemporal spaces. Severe conditions such as Ludwig's Angina and secondary respiratory embarrassment, local periorbital cellulitis, cavernous sinus thrombosis, systemic meningitis and sepsis can also occur.^{3, level III}

Key messages 1:

- In its early stage, cellulitis feels soft and doughy to palpation
- In its advanced and serious form, it is firm, indurated and painful.
- It then progresses to abscess formation where the swelling will be more localized, fluctuant and tender on palpation, along with red periphery and pus formation
- Prompt diagnosis and management is critical for paediatric patients

Recommendation 1:

Clinicians should be able to recognise the early stage of the disease to institute rapid intervention and to prevent complications. **(Grade C)**

4. DIAGNOSIS

History taking and clinical examination are usually sufficient to arrive to a diagnosis and progression of AOI. ^{11, level III} Simple questions such as a history of toothache before swelling, history of recent dental treatment (to identify possible cause of infection) and onset of swelling (to determine the rapidness of spread of infection) should form part of the overall history taking. Other further investigations that can be considered to facilitate diagnosis and management should include:

1. Radiographs:

Standard plain radiographs

- Intra oral periapical radiograph
- Simple occlusal radiograph
- Orthopantomograph (**Figure 3**)

Further imaging tests:

- Ultra sonography (to evaluate presence of pus collection) ^{12, level III}
- CT scan (to evaluate extension of spread, such as neck spaces, periorbital or cases of multi space involvement) ^{13, level III}

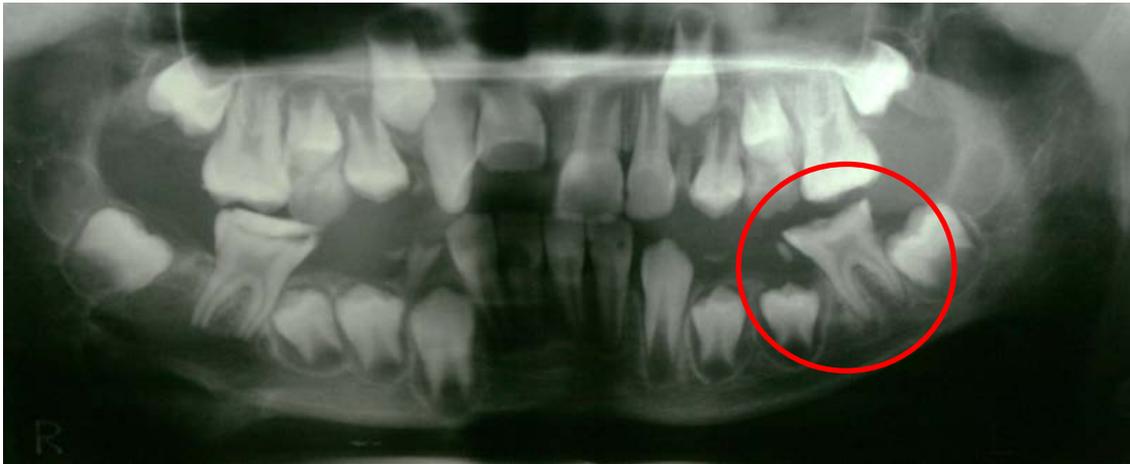
2. Sensibility tests:

- Electric pulp test
- Thermal (hot and cold) test

3. Culture and antimicrobial sensitivity testing

This is important in certain situations such as those in rapidly spreading infections, patients not responding to empirical therapy and in immunocompromised patients. ^{14, level III} The ideal clinical sample if an acute abscess develops is an aspirate through intact mucosa disinfected by an appropriate antiseptic mouthwash or swab (such as chlorhexidine) or purulent exudates from within infected canals. ^{15, level III; 16, level I} This will reduce contamination from the normal oral flora. Swabs of purulent material have demonstrated poor recovery of strict anaerobes and low mean numbers of isolates per sample (range 1.0–1.6). ^{16, level I}

Figure 3: OPG with periapical radiolucency of a grossly carious tooth (36)



Recommendations 2:

- Diagnosis of AOI should be made mainly by clinical assessment (**Grade C**)
- There are various imaging technique available however, plain radiograph should be the standard imaging for assessment of AOI (**Grade C – Development Group’s consensus**)

5. CRITERIA FOR HOSPITALISATION AND REFERRAL

Following the history taking, clinical examination and investigations performed, the clinician needs to make a decision as to whether to treat as outpatient or as inpatient. Mild cases of AOI can be treated at primary health care settings as outpatient with timely follow-up to monitor progress of disease. However, the following conditions would require hospitalisation:

1. Compromised airway (difficulty in breathing, stridor / abnormal breath sounds)*
2. Raised floor of mouth* (**Figure 4**)
3. Systemically unwell (ill appearance, fever, malaise, lethargic, dehydration)^{17, level III}
4. Limitation of mouth opening / trismus
5. Rapidly progressive lesion / multi space spread
6. Poor compliance to oral therapy

7. Reduced oral intake
8. Failure of outpatient therapy (oral medication)
9. Unable to access to medical care in a timely fashion

Figure 4: Photo of child with raised floor of mouth



Note: These conditions require complex care which are best managed by Paediatric Dental Specialist. Any cases managed by clinicians as in-patient (e.g. due to logistic issues, child is too unwell, unable to refer in a timely manner, social issues), should be in consultation with Paediatric Dental Specialist. *Conditions 1 and 2 shall warrant urgent referral to hospitals capable for emergency intubation and Intensive Care Unit backup.

Apart from the above mentioned conditions, the following criteria also warrant referral to the Paediatric Dental Specialist:

1. Rapid progression and involvement of multiple spaces and secondary anatomic spaces ^{2 level III}
2. Immunocompromised patients
3. No nearby facility for hospital admission
4. Require further investigation such as CT scan
5. Unable to perform surgical intervention
6. Uncooperative patients
7. Require comprehensive dental treatment under general anaesthesia

Recommendation 3:

Consultation with / or referral to the Paediatric Dental Specialist is recommended for moderate to severe cases of AOI. **(Grade C)**

6. INDICATIONS FOR REFERRAL TO OTHER MEDICAL SPECIALTIES

Referral to other medical specialties (Ophthalmology, Otorhinolaryngology, Paediatrics, etc.) is required for:

1. Patients with sign of airway obstruction shall warrant urgent referral to Otorhinolaryngologist.
2. Patients with AOI which has extended to the orbit with signs of eyelid (periorbital) swelling **(Figure 5)**, double vision (diplopia), reduced visual acuity, abnormal light reflexes, protrusion of the eyeball (proptosis), or impairment of eye movement (ophthalmoplegia).^{18-23, level III}

Figure 5: Photo of child with periorbital swelling



3. Patients who appears to be systemically ill, or having fever, severe malaise or even presents with signs of central nervous system involvement such as drowsiness, lethargy, vomiting, headache, seizure, or cranial nerve deficit. ^{18-21, 23, level III}
4. Patients with deep and rapidly spreading infections (such as multi space infection, deep neck infection). ^{24-26, level III}
5. Patients with severe and systemic signs of sepsis (high fever or hypothermia, tachycardia, hypotension). ^{25, 27, level III}
6. Patients with underlying disease, such as diabetes mellitus, or immune dysfunction. ^{10, 25-26, level III}

Recommendation 4:

Interdisciplinary team should be formed to manage advance and complex cases of AOI.

(Grade C – Development Group’s consensus)

7. MANAGEMENT OF AOI

The common practice in the management of AOI is removal of the source of infection (extraction or pulp therapy) and administration of antibiotics with / without incision and drainage.

7.1. Surgical intervention

Different studies vary in their recommendation on timing of surgical intervention (extraction of causative tooth/teeth with/without incision and drainage). There are generally two modes of management of AOI: ^{3,5,6,28, level III}

- a) Pharmacological therapy with immediate surgical intervention
- b) Pharmacological therapy with delayed surgical intervention

The timing of surgical intervention is based on the patients' medical stability, access to the oral cavity's surgical site and availability of the operating theatre if general anaesthesia is needed. Nevertheless, in cases of persistent or rapid progression of infections despite optimal medical therapy given, surgical intervention (**Figure 6**) must be instituted immediately. ^{6, level III} In the scenario where the child is uncooperative and has other carious teeth to be managed, comprehensive dental treatment under general anaesthesia is recommended. Furthermore, the chance for readmission will be reduced. ^{6, level III} The removal of the source of infection either by extraction or pulp therapy (**Figure 7**) of the offending tooth mainly depends on several others factors that include restorability, cooperativeness of the child, medical problems and orthodontic considerations.

Figure 6: Post Extra-oral Incision and Drainage with rubber drain in-situ



Figure 7: Root Canal Treatment on Tooth 46



Key message 2:

It is imperative that the source of infection be removed as soon as possible in cases of AOI

Recommendation 5:

- Antibiotics should be administered immediately. Surgical intervention should not be delayed if possible.
- Comprehensive dental treatment under general anaesthesia is recommended in an uncooperative child with multiple carious teeth.

(Grade C)

7.2. Management of pain

There are several medication options to manage pain resulting from facial cellulitis such as Paracetamol, Ibuprofen, Naproxen and Diclofenac. These medications are adequate to manage mild pains; however for moderate or severe pains require combination with other agents, most commonly the opioid group.^{29, level III} Paracetamol is the first-line treatment for most mild to moderate acute pain due to its favourable safety and cost profiles.^{30, level I}

7.3. Types of Antibiotics

Judicious use of antibiotic for therapy in odontogenic cellulitis is imperative in preventing antibiotic resistance.^{15, level III} The antibiotics used must reach the site of infection at a therapeutic level and adequate duration to produce the desired effect and should be provided as soon as possible.^{31, level III} Most common facultative bacterial isolated were *viridans streptococci*, *Neisseria* and *Eikenella* species. Among anaerobes, *Prevotella* and *Micromonas* (formerly *Peptostreptococcus* species) were more frequent.^{32, level I; 33, level III}

Penicillin remains the antibiotic of choice for mild to moderate odontogenic infections in the fit and healthy child. However, it is not recommended as initial therapy for more

serious infections possibly due to penicillin resistant oral anaerobes.^{14, level III} Oral phenoxymethylpenicillin (penicillin V) is the penicillin of choice for odontogenic infections in comparison to benzylpenicillin (penicillin G). It has higher acid stability and produces plasma levels that are two to five times higher than an equivalent dose of penicillin G.^{34, level III} However, penicillin has limited activities against anaerobes. Therefore, a combination of penicillin with metronidazole, which is active against anaerobes, is recommended.^{15, level III; 16, level I}

Besides penicillin, ampicillin and amoxicillin remains the alternative line of antibiotic. Amoxicillin is better absorbed orally than penicillin V.^{34, level III} In cases of beta lactam antibiotic (penicillin, ampicillin, amoxicillin, cephalosporin) resistance, broad spectrum antibiotics such as amoxicillin/clavulanate (Augmentin) or ampicillin/sulbactam (Unasyn) can be used and generally reserved for more severe orofacial infections.^{32, level I}

In individuals who are allergic to the penicillin group, clindamycin remains as an alternative.^{35,36 level I, 15, level III} Clindamycin is active against *Streptococci* while methicillin susceptible *Staphylococci*. Its spectrum of activity includes nearly all the likely pathogens of odontogenic infections, with the notable exception of *Eikenella corrodens*. It exhibits superior penetration into the jawbone and abscess cavities and it has an advantage over metronidazole that it can be used as monotherapy.^{14, level III} It is recommended that clindamycin should probably be reserved for odontogenic infections serious enough to require hospitalisation. The main concern in the past was pseudomembranous colitis due to superinfection with *Clostridium difficile*. However, it is now known that this condition can occur as an adverse effect of other antibiotics too. The overall incidence of clindamycin-induced *C. difficile* diarrhoea is probably less than 1%.^{14, level III}

First-generation cephalosporin antibiotics (e.g. cephalexin, cephalothin) and second-generation cephalosporin antibiotics (e.g. cefuroxime, cefaclor, cefoxitin) have a significantly broader spectrum of activity than penicillins.^{37, level I; 34, level III} and are very active against aerobic and anaerobic gram-positive cocci but are generally

unpredictable in their activity against anaerobic gram-negative rods, although for some isolates expanded-spectrum cephalosporins will be effective. ^{14,34,38, level III}

Erythromycin remains a useful and cost effective agent for the treatment of mild odontogenic infections in penicillin-allergic patients. There is, however, an increase in erythromycin resistance among oral anaerobes, especially fusobacteria, ^{39,40, level III} viridians group streptococci, *Prevotella* species ^{39, level III} and gram positive anaerobic cocci (GPAC). ^{41, level III} Azithromycin has been found to be the most active macrolide antibiotic against oral gram-negative anaerobes, and showing activity against oral *streptococci* comparable to that of erythromycin, and is probably the most suitable agent for this group of orofacial odontogenic infections. ^{14, level III}

Antibiotics of choice for odontogenic infection are as in **Table 1.** ^{2,38,42, level III}

Table1: Recommended antibiotics and dosage

Severity of infection	Recommended antibiotic	Dosage
Mild infection	Phenoxymethyl Penicillin	Phenoxymethyl Penicillin 125mg Tablet Phenoxymethyl Penicillin 250mg Tablet ADULT: 500-750mg 6 hourly. CHILD; up to 1 year: 62.5mg 6 hourly, 1-5 years: 125mg 6 hourly, 6-12 years: 250mg 6 hourly. Phenoxymethyl Penicillin 125mg/5ml Syrup CHILD: Up to 1 year: 62.5mg 6 hourly, 1-5 years: 125mg 6 hourly; 6-12 years 250mg 6 hourly.
	OR Ampicillin	Ampicillin Trihydrate 125mg/5ml Suspension CHILD: 50-100mg/kg/day 4 times daily. Under 1 year: 62.5-125mg 4 times daily, 1-10 years: 125-250mg 4 times daily. Ampicillin Sodium 500mg Injection 250-500mg IM/IV every 4-6 hours. Maximum: 400mg/kg/day. CHILD: 150mg/kg/daily IV in divided doses. Usual children dose less than 10 years, half adult dose.
	OR Amoxicillin	Amoxicillin 250mg Capsule ADULT: 250-500mg 3 times daily. CHILD: 20-40mg/kg/day in divided doses 8 hourly.

Severity of infection	Recommended antibiotic	Dosage
	OR Cephalosporin (e.g. cephalexin)	Cephalexin Monohydrate 125mg/5ml Syrup Cephalexin Monohydrate 250mg/5ml Syrup CHILD: 25-100mg/kg/day every 6 hourly. Maximum: 4g daily
No improvement within 2-3 days or Moderate – Severe infection	Penicillin/Ampicillin/Amoxicillin and Metronidazole	Dosage for Penicillin/Ampicillin/Amoxicillin as above Dosage for Metronidazole Metronidazole 200mg Tablet ADULT: Initially 800mg followed by 400mg 8 hourly for about 7 days Other recommended doses: 500mg 8 hourly or 7.5mg/kg 6 hourly (max:4g in 24 hours) CHILD: 7.5mg/kg 8 hourly Tab: Should be taken with food Metronidazole 200mg/5ml Suspension CHILD: 7.5mg/kg 3 times daily for 7 days. Metronidazole 500mg/100ml Injection ADULT: 500mg IV infusion 8 hourly. CHILD: 7.5mg/kg body weight every 8 hours. 1 month-18years: 7.5mg/kg (maximum 500mg) every 8 hours
	OR Amoxicillin & Clavulanate	Amoxicillin & Clavulanate 228mg/5ml Syrup Mild to Moderate infections: 25mg/kg/day (based on Amoxicillin dose) in 2 divided doses Severe infection: 45mg/kg/day (based on Amoxicillin dose) in 2 divided doses Amoxicillin 1g & Clavulanate 200mg Injection Amoxicillin 500mg & Clavulanate 100mg Injection ADULT: 1.2g by IV or intermittent infusion 6-8 hourly. CHILD: less than 3 months 30mg/kg 12 hourly, 3 months-12 years 30mg/kg 6-8 hourly. Amoxicillin 500mg & Clavulanate 125mg Tablet ADULT & CHILD more than 12 years: Mild-moderate infections: 625mg twice daily.
	OR Ampicillin / Sulbactam	Ampicillin Sodium & Sulbactam Sodium 250mg/5ml Suspension ADULT: (1-) 2-6g daily CHILD: (25-) 50-100mg/kg daily Ampicillin Sodium & Sulbactam Sodium 375mg Tablet ADULT: 375-750mg twice daily CHILD: 25-50mg/kg/day in 2 divided doses, if ≥ 30 kg use an adult dose Ampicillin Sodium 1g & Sulbactam Sodium 500mg Injection

Severity of infection	Recommended antibiotic	Dosage
		Ampicillin Sodium 500mg & Sulbactam Sodium 250mg Injection ADULT: 1.5-12g/day in divided doses 6-8 hourly. Maximum: 4g Sulbactam. CHILD: 150-300mg/kg/day 6-8 hourly
	OR Cephalosporin (e.g. cefuroxime)	Cefuroxime Axetil 125mg Tablet Cefuroxime Axetil 250mg Tablet ADULT: 250mg twice daily. CHILD: 30mg/kg/day in 2 divided doses, up to 500mg daily Cefuroxime Axetil 125mg/5ml Suspension 30mg/kg/day in 2 divided doses up to 500mg daily Cefuroxime Sodium 250mg Injection Cefuroxime Sodium 750mg Injection Cefuroxime Sodium 1.5 Injection ADULT: 750mg every 6-8 hours as IM or IV. Severe infections: 1.5g every 6-8 hours as IV CHILD: 30-100mg/kg/day in 3-4 divided doses.
ALLERGY TO PENICILLIN		
Allergy to penicillin	Clindamycin	Clindamycin HCL 300mg Capsule ADULT: 150-300mg every 6 hours; up to 450mg every 6 hours in severe infections; Max:1.8g/day CHILD: 3-6mg/kg every 6 hours. Children weighing <10kg should receive at least 37.5mg every 8 hours Clindamycin Phosphate 150mg/ml Injection ADULT: 0.6-2.7g daily (in 2-4 divided doses); up to 4.8g daily. CHILD: over 1 month, 20-40mg/kg/day
	OR Macrolides Azithromycin	Azithromycin 200mg/5ml Granules CHILD 36-45kg: 400mg, 26-35kg: 300mg, 15-25kg: 200mg, less than 15kg: 10mg/kg. To be taken daily for 3 days or to be taken as a single dose on day 1, then half the daily dose on days 2-5.
	OR Erythromycin	Erythromycin Ethylsuccinate 200mg/5ml Suspension Erythromycin Ethylsuccinate 400mg/5ml Suspension CHILD: 30-50mg/kg daily, increased to twice the usual dose in severe cases. 2-8 years: 1g daily in divided doses; <2 years: 500mg daily in divided doses Erythromycin Ethylsuccinate 400mg Tablet ADULT: 400mg 6 hourly or 800mg 12 hourly. Maximum

Severity of infection	Recommended antibiotic	Dosage
		4g/day. CHILD: 30-50mg/kg/day in divided doses. Children 2-8 years 1g/day in divided doses in severe cases. Infant and children \leq 2 years 500mg/day in divided doses Erythromycin Stearate 250mg Tablet CHILD: 30-50mg/kg daily, increased to twice the usual dose in severe cases 2-8 years: 1g daily in divided doses <2 years: 500mg daily in divided doses

Note:

- Recommended dosages are based on Ministry of Health Medicines Formulary 2016.^{42, level III}
- Paediatric dosage should not exceed adult dosages mentioned above.^{43, level III}

8. MONITORING PROGRESS OF TREATMENT AND DISCHARGING PATIENT

The progress of treatment should be monitored to evaluate the success of the treatment, the need for further surgical intervention, or to determine the need to change the antibiotics. Among the signs of satisfactory progress are as follow:

- Improved oral intake
- Improved systemic (e.g. no episodes of spiking temperature) and general condition
- Controlled pain
- Reduced soft tissue swelling
- Improved mouth opening
- Reduced pus discharge / collection

If the patient is deemed fit for discharge based on the above observations, the patient should be discharged with oral antibiotics to complete the duration of therapeutic regime. Patients should be followed up to ensure complete resolution of infection.

9. CONCLUSIONS

AOI in children should be managed promptly based on adequate clinical examination and radiographic investigation. Moderate to severe cases of AOI may require referral and hospitalisation for further management. Adhering to the proposed algorithm will ensure a systematic management of the patient and timely referral to the specialist for optimal outcome.

10.IMPLEMENTING THE GUIDELINES

It is important to standardise the management of AOI at all healthcare levels in Malaysia by using an evidence-based CPG in order to manage AOI appropriately. An updated knowledge of appropriate management is a key factor in the successful treatment outcome. The successful treatment outcome is influenced by factors such as the ability of clinicians to diagnose AOI in children. Timely and appropriate management with thorough examination are also important factors influencing the successful treatment outcome.

Facilitating and Limiting Factors

Existing facilitators for application of the recommendations in the CPG include:

- a) Wide dissemination of the CPG to healthcare professionals via printed and electronic copies.
- b) Continuing professional education on the management of AOI for healthcare professionals.
- c) Widespread of facilities at primary care level for screening and detection of AOI

Existing barriers for application of the recommendations of the CPG include:

- a) Poor understanding or limited knowledge of AOI
- b) Insufficient resources in the management of AOI particular at specialist care
- c) Variation in treatment practice and preferences

Potential Resource Implications

To implement the CPG, there must be strong commitment to:

- a) Ensure widespread distribution of the CPG to healthcare professionals.
- b) Re-enforce training of healthcare professionals to ensure updated information, especially in terms of screening at primary care level and multidisciplinary team at secondary care level
- c) Ensure budget allocation as the cost implication on the management of AOI in children varies depending on several factors, such as severity of the condition, patient's age, the need for hospitalisation and treatment under

general anaesthesia. Early detection of the disease and appropriate management will reduce the cost.

Proposed Clinical Audit Indicators

To assist in the implementation of the CPG, the following are proposed as clinical audit indicators for quality management:

Successful management of AOI	=	$\frac{\text{No. of AOI cases without complication}}{\text{No. of AOI cases}} \times 100$
<p>Successful management of AOI = Complete resolution of infection.</p> <p>Standard = 100%. Any shortfalls in this must be investigated to identify causative factors, such as inadequacy in management or other comorbid conditions such complex medically compromised patients</p>		

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Appendix 1**SEARCH STRATEGY**

The following MeSH terms or free text terms were used either singly or in combination, search was limit to English, and human:

Introduction and Epidemiology	Diagnosis
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<ul style="list-style-type: none"> • Acute disease • Infection • Mouth • Orofacial • Prevalence • Epidemiology • Aetiology • Dental caries • Paediatrics <p>Clinical presentations</p> <ul style="list-style-type: none"> • Signs and symptoms • Cellulitis • Fever • Pain • Trismus • Oedema • Abscess • Ludwig's Angina 	<ul style="list-style-type: none"> • Diagnosis • Oral examination • Medical History Taking • Orthopantomography • Radiography • Panoramic • CT scan • Dental pulp test • Culture test <p>Management</p> <ul style="list-style-type: none"> • Pain management • Anti-Bacterial Agents • Tooth extraction • General anaesthesia • Surgery oral
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Appendix 2

CLINICAL QUESTIONS

The clinical questions addressed by these guidelines are as follows:

1. What are the epidemiological characteristics of AOI?
2. What are the clinical presentations of AOI?
3. How to diagnose a child with AOI?

4. What are the indications for hospitalisation and for referral to Paediatric Dental Specialist?
5. What are indications for referral to other medical specialties?
6. Management of AOI:
 - a. When should surgical intervention for AOI be carried out?
 - b. What are the effective / safe analgesics to be used in AOI?
 - c. What are the effective / safe antibiotics to be used in AOI?
7. What are the criteria on how to assess AOI that is under controlled and for discharging patient?

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