ព្រះរាជាណាចក្រកម្ពុជា

ជាតិ សាសនា ព្រះមហាក្សត្រ

មគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិក

CLINICAL PRACTICE GUIDELINES

ផ្នែក

FOR

ទន្តសាស្ត្រ

DENTISTRY

ដាយកដ្ឋានសេវាសុខភាព

ឆ្នាំ ២០២៥

Kingdom of Cambodia
Nation Religion King

CLINICAL PRACTICE GUIDELINES *FOR* DENTISTRY

Department of Health Services

December 2025

Ministry of Health

CLINICAL PRACTICEGUIDELINES FOR DENTISTRY

December 2025

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងសុខាតិបាល
លេខ ០៣ ៦៣ សហវ/ន.ស.ប្រ

ប្រកាស
ស្តីពី
ការជាក់ឱ្យអនុវត្តមគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិក ផ្នែកឧទ្ធសាស្ត្រ

រដ្ឋមន្ត្រីក្រសួងសុខាតិបាល

- បានឃើញរដ្ឋធម្មនុញ្ញនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/០៨២៣/១៩៨១ ចុះថ្ងៃទី២២ ខែសីហា ឆ្នាំ២០២៣ ស្តីពីការតែងតាំងរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/០២២៤/២០៥ ចុះថ្ងៃទី២១ ខែកុម្ភៈ ឆ្នាំ២០២៤ ស្តីពីការបំពេញបន្ថែមសមាសភាពរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/០៩២៤/១១៦៩ ចុះថ្ងៃទី២០ ខែកញ្ញា ឆ្នាំ២០២៤ ស្តីពីការកែសម្រួល និងតែងតាំងសមាសភាពរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/១១២៤/១៤៧៧ ចុះថ្ងៃទី២០ ខែវិច្ឆិកា ឆ្នាំ២០២៤ ស្តីពីការកែសម្រួល និងតែងតាំងសមាសភាពរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រមលេខ នស/រកម/០៦១៨/០១២ ចុះថ្ងៃទី២៨ ខែមិថុនា ឆ្នាំ២០១៨ ដែលប្រកាសឱ្យប្រើច្បាប់ ស្តីពីការរៀបចំ និងការប្រព្រឹត្តទៅនៃគណៈរដ្ឋមន្ត្រី
- បានឃើញព្រះរាជក្រមលេខ នស/រកម/០១៩៦/០៦ ចុះថ្ងៃទី២៤ ខែមករា ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីការបង្កើតក្រសួងសុខាតិបាល
- បានឃើញព្រះរាជក្រមលេខ នស/រកម/១១១៦/០១៤ ចុះថ្ងៃទី១៦ ខែវិច្ឆិកា ឆ្នាំ២០១៦ ដែលប្រកាសឱ្យប្រើច្បាប់ ស្តីពីការគ្រប់គ្រងអ្នកប្រកបវិជ្ជាជីវៈសុខាភិបាល
- បានឃើញអនុក្រឹត្យលេខ២៣៩ អនក្រ.បក ចុះថ្ងៃទី០៣ ខែធ្នូ ឆ្នាំ២០២៥ ស្តីពីការរៀបចំ និងការប្រព្រឹត្តទៅរបស់ក្រសួងសុខាតិបាល
- យោងតាមការចាំបាច់របស់ក្រសួងសុខាតិបាល

អាសយដ្ឋាន៖ ដីឡូត៍លេខ៨០ វិថីសម្តេច ប៉ែន នុត (២៨៩) សង្កាត់បឹងកក់ទី២ ខណ្ឌទួលគោក រាជធានីភ្នំពេញ
ទូរស័ព្ទ៖(+៨៥៥) ២៣ ៨៨៥ ៩៧០
អ៊ីម៉ែល៖ info@moh.gov.kh
គេហទំព័រ៖ www.moh.gov.kh
តេឡេក្រាម៖ t.me/MOHCambodia

សម្រេច

ប្រការ១.-

ត្រូវបានដាក់ឱ្យអនុវត្តមគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិក ផ្នែក ទន្តសាស្ត្រ (Clinical Practice Guidelines For Dentistry) ដែលជាឧបសម្ព័ន្ធនៃប្រកាសនេះ។

ប្រការ២.-

ប្រកាសនេះមានវិសាលភាពអនុវត្តចំពោះគ្រប់មូលដ្ឋានសុខាភិបាលសាធារណៈ និងឯកជនក្នុងព្រះរាជាណាចក្រកម្ពុជា។

ប្រការ៣.-

បទប្បញ្ញត្តិទាំងឡាយណាដែលផ្ទុយនឹងប្រកាសនេះ ត្រូវទុកជានិរាករណ៍។

ប្រការ៤.-

អគ្គលេខាធិការ អគ្គនាយកបច្ចេកទេសសុខាភិបាល អគ្គាធិការក្រសួងសុខាភិបាល គ្រប់ប្រធានអង្គភាពក្រោមឱវាទក្រសួងសុខាភិបាល ទាំងមូលដ្ឋានសុខាភិបាលសាធារណៈ និងឯកជន ត្រូវទទួលបន្ទុកអនុវត្តតាមប្រកាសនេះឱ្យមានប្រសិទ្ធភាព ចាប់ពីថ្ងៃចុះហត្ថលេខាតទៅ។

ថ្ងៃ ៣កើត ខែបុស្ស ឆ្នាំម្សាញ់ សប្តស័ក ព.ស.២៥៦៩
ធ្វើនៅរាជធានីភ្នំពេញ ថ្ងៃទី ៣១ ខែ ក្ក ឆ្នាំ២០២៥

រដ្ឋមន្ត្រីក្រសួងសុខាភិបាល

សាស្ត្រាចារ្យ ឈាង រ៉ា

កន្លែងទទួលៈ
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ចនិងហិរញ្ញវត្ថុ
- ខុទ្ទកាល័យឯកឧត្តមសាស្ត្រាចារ្យរដ្ឋមន្ត្រីក្រសួងសុខាភិបាល
- ដូចប្រការ៤
- រាជកិច្ច
- ឯកសារ កាលប្បវត្តិ

អារម្ភកថា

ក្រោមកិច្ចដឹកនាំរបស់រាជរដ្ឋាភិបាលនីតិកាលទី៧ នៃរដ្ឋសភា នៃ **ព្រះរាជាណាចក្រកម្ពុជា** ក្រសួងសុខាភិបាល យកចិត្តទុកដាក់ខ្ពស់ដល់សុខភាព និងសុខុមាលភាពប្រជាជនគ្រប់រូប និងប្តេជ្ញាចិត្តយ៉ាងមុឺងម៉ាត់លើកកម្ពស់ការផ្តល់សេវាសុខាភិបាលប្រកបដោយ គុណភាព សុវត្ថិភាព និងសមធម៌ ដោយផ្តោត លើអ្នកជំងឺ ជូនដល់ប្រជាជនកម្ពុជាគ្រប់រូបស្របតាម ផែនការយុទ្ធសាស្ត្រសុខាភិបាល ២០២៥-២០៣៤ ក៏ដូចជា ផែនទីបង្ហាញផ្លូវឆ្ពោះទៅការគ្របដណ្តប់សុខភាពជាសកលនៅកម្ពុជា ឆ្នាំ ២០២៤-២០៣៥ របស់ រាជរដ្ឋាភិបាល។

មគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិកផ្នែកទន្តសាស្ត្រនេះជាមគ៌ាណែនាំថ្នាក់ជាតិពាក់ព័ន្ធនឹងពិធីសារ នៃការគ្រប់គ្រងបញ្ហាសុខភាពពាក់ព័ន្ធផ្នែកទន្តសាស្ត្រជាអាទិភាព នៅកម្ពុជា ផ្តោតសំខាន់លើបែបបទ នៃការធ្វើរោគវិនិច្ឆ័យ និងការថែទាំ ការព្យាបាល និងការបង្ការជំងឺ រាប់ទាំងការតាមដានបញ្ហាសុខភាព ឬជំងឺ ។

មគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិកផ្នែកទន្តសាស្ត្រនេះជាសៀវភៅដែលបានចងក្រងលើកដំបូងនៅកម្ពុជា ដោយក្រុមការងារបច្ចេកទេសជំនាញ នៃក្រសួងសុខាភិបាល និងមានការចូលរួមពីដៃគូសំខាន់ៗ អ្នកជំនាញ ឯកទេសជំនាញពីផ្នែកពាក់ព័ន្ធទាំងឡាយ រួមទាំងគ្រូពេទ្យព្យាបាល និងទន្តបណ្ឌិត បម្រើការងារនៅតាមមន្ទីរពេទ្យនៅគ្រប់លំដាប់ថ្នាក់មន្ត្រីបំពេញការងារនៅការិយាល័យសុខាភិបាលស្រុកប្រតិបត្តិ និងមន្ទីរសុខាភិបាល នៃរដ្ឋបាលរាជធានី ខេត្ត កម្មវិធីជាតិ សមាគមវិជ្ជាជីវៈសុខាភិបាលផ្សេងៗ ក៏ដូចជាអង្គការដៃគូពាក់ព័ន្ធ។

មគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិកនេះ ត្រូវបានរៀបចំឡើងសម្រាប់អ្នកវិជ្ជាជីវៈសុខាភិបាល និងអ្នកវិជ្ជាជីវៈពាក់ព័ន្ធ ជាពិសេសអ្នកផ្តល់សេវាសុខភាព រាប់បញ្ចូលទាំង វេជ្ជបណ្ឌិត ទន្តបណ្ឌិត និងអ្នកប្រកបវិជ្ជាជីវៈ សុខាភិបាលផ្សេងទៀត នៅមូលដ្ឋានសុខាភិបាលសាធារណៈ និងឯកជន ក៏ដូចជាសិក្ខាកាម អ្នករៀបចំគោលនយោបាយ អ្នកពាក់ព័ន្ធនានា គណៈវិជ្ជាជីវៈ និងសមាគមវិជ្ជាជីវៈផ្សេងៗ។

ក្រសួងសុខាភិបាលសូមណែនាំដល់អ្នកវិជ្ជាជីវៈសុខាភិបាល និងអ្នកពាក់ព័ន្ធទាំងអស់ ត្រូវចូលរួមអនុវត្តតាមមគ្គុទ្ទេសក៍ព្យាបាលគ្លីនិកនេះ សម្រាប់ប្រតិបត្តិកិច្ចការរបស់ខ្លួន ក្នុងគោលបំណងពង្រឹងប្រសិទ្ធភាព ប្រសិទ្ធផល និងគុណភាព សុវត្ថិភាពក្នុងការថែទាំព្យាបាលអ្នកជំងឺ ក៏ដូចជាការកសាងសមត្ថភាពធនធានមនុស្សក្នុងវិស័យសុខាភិបាល ។

រាជធានីភ្នំពេញ ថ្ងៃ...៣១.....ខែធ្នូ ឆ្នាំ ២០២៥

រដ្ឋមន្ត្រីក្រសួងសុខាភិបាល

សាស្ត្រាចារ្យ ឈាង រ៉ា

FOREWORD

Under the leadership of the Royal Government of the 7th Legislature of the National Assembly of the Kingdom of Cambodia, the Ministry of Health pays high attention to the health and well-being of the entire population. The Ministry of Health is strongly committed to ensuring the provision of equitable, safe and quality patient-centered health services for the Cambodian population in line with the Health Strategic Plan 2025-2034 and the Royal Government Roadmap Towards Universal Health Coverage in Cambodia 2024-2035.

This Clinical Practice Guidelines (CPG) for Dentistry provides national guidance on the management protocols of priority health problems related to dentistry with a focus on diagnosis and care, including curative and preventive care, as well as follow-up of health problems.

The Guidelines, first ever published in Cambodia, was developed by the Technical Working Group of the Ministry of Health with participation from various stakeholders and individuals, including experts from relevant fields ranging from clinicians and dentists working in hospitals at all levels to district health officers, Provincial Health Departments, national programs, health professional associations, as well as partner organizations.

The Guidelines is intended for use by health professionals and other relevant professionals, especially health care providers, including doctors, dentists and other health practitioners in both public and private health facilities as well as trainees, policymakers, relevant individuals, professional councils and professional associations.

The Ministry of Health guides all health professionals and relevant individuals to use this Guidelines in their professional practice with the aim of improving effectiveness, efficiency and quality in patient care and safety, as well as contributing to human resource capacity building.

Phnom Penh, 31 December, 2025

Minister of Health

Prof. CHHEANG RA

ACKNOWLEDGEMENT

The Ministry of Health wishes to extend its profound appreciation to Excellencies, Ladies and Gentlemen, Professors, Doctors, Dentists, Pharmacists, Experts, Officials of the Ministry at all levels, as well as partner organization officials and all individuals who have shared their experiences and inputs contributing to the development of this important Clinical Practice Guidelines.

We particularly thank H.E. Prof. **Oeurn Boraroth,** Secretary of State, Chair and all Vice-chairs and members of the Technical Working Group of Clinical Practice Guidelines for Dentistry, under the overall leadership and guidance of the Steering Committee for National Medical Care and Therapy of the Ministry of Health.

We would also like to express our deep gratitude to all partners involved, including the World Health Organization and other partners, for their technical and financial contributions to the formulation of the guidelines.

This Clinical Practice Guidelines for Dentistry represent another significant and commendable achievement of the Ministry of Health of the Kingdom of Cambodia.

Phnom Penh, 31 December, 2025

Chair of the Steering Committee for

National Medical Care and Therapy

H.E. Prof. Yit Sunnara

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Abbreviations

ABC	Aneurysmal Bone Cyst
AI	Amelogenesis imperfecta
AIDS	Acquired immune deficiency syndrome
AMR	Antimicrobial resistance
ANB	A point-Nasion-B point
aPDT	Antimicrobial photodynamic therapy
aPTT	activated partial thromoplastin time
Ar to Go	Articulare to Gonion
ART	Atraumatic Restorative Treatment
BDUC	Bleeding disorder of unknown cause
BIPP	bismuth subnitrate and iodoform paste
BOP	bleeding on probing
BPE	Basic Periodontal Examination
BSSO	bilateral sagittal split osteotomy
BT	Bleeding time
CABG	Coronary artery bypass graft
CAD/CAM	Computer-Aided Design /Computer aided manufacturing
CAL	clinical attachment loss
CBC	Complete blood count
CBCT	Cone cone-beam computed tomography Beam CT
CDC	Centers for Disease Control
CHF	Congestive heart failure
COX-2	Cyclooxygenase-2
CPI	Community Periodontal Index
CPP-ACP	Casein Phosphopeptide-Amorphous Calcium Phosphate
CS1-CS2	CVM Stage1 -CVM Stage 2
CS3-CS4	CVM Stage3 -CVM Stage 4
CS5-CS6	CVM Stage5 -CVM Stage 6
CT	Clotting time
CT	computed tomography
CVA	cerebrovascular accident
CVM	Cervical Vertebrae Maturation
DMF	Decayed, Missing, Filling
dmft	decayed, missing, filling teeth
ECC	Early childhood caries

EDTA	Ethylenediaminetetraacetic acid
eGFR	estimated glomerular filtration rate
EMD	enamel matrix derivative
Er,Cr:YSGG lasers	erbium, chromium-doped: yttrium, scandium, gallium, garnet lasers
Er:YAG lasers	erbium-doped yttrium aluminium garnet lasers
ESRD	end stage renal disease
F	Fluoride
FMA	Frankfort-mandibular plane angle
FPM	first permanent molars
GBR	Guided bone regeneration
GDP	Gross domestic product
GDP	general dental practitioner
GECB	Guaiacol, Eugenol, Chlorobutanol, Balsam Peru
GFS	growth factor stimulation
GIC	Glass ionomer cement
Go to Me	Gonion to Menton
GTR	Guided tissue regeneration
HLLT	High-power laser therapy
IAN	inferior alveolar nerve
IBD	inflammatory bowel disease
IE	infective endocarditis
IL-1α	Interlerukin -1alpha
IMPA	Incisor Mandibular Plane Angle
INR	international normalised ratio
IOPA	intraoral periapical
KCOT	keratocystic odontogenic tumor
kg	kilogram
Ki-67	Antigen Kiel 67
LLHA	Lower Lingual Holding Arch
LLLT	Low level laser therapy
MAGIC	Mouth and genital ulcers with inflamed cartilage
MD	Mesial-Distal
mg	milligram
MI	myocardial infarction
MI Paste	Minimal Intervention Paste
MIH	Molar incisor hypomineralization
MIH-TNI	Molar incisor hypomineralization-Treatment Need Index
MKI67	Marker of proliferation Kiel 67
mL	milliliter
mm	millimetre

MRI	magnetic resonance imaging
mRNA	messenger ribonucleic acid
MRONJ	Medication Related Osteonecrosis of the Jaw
mW	milliwatts
N	Nasion
NaF	sodium fluoride
NaOCl	Sodium hypochlorite
NBCCS	Nevoid Basal Cell Carcinoma Syndrome
nm	nanometre
NOHS	National Oral Health Survey
Nper-A	Nasion perpendicular to A point
Nper-Pog	Nasion perpendicular to Pogonion
NSAIDs	Nonsteroidal anti-inflammatory drugs
OFD	Open-flap debridement
OHI	oral hygiene instructions
OKC	Odontogenic keratocyst
OPG	Panoramic radiograph
OPG	Orthopantomograms
ORN	Osteoradionecrosis
PA	Intraoral periapical radiographs
PBM	photobiomulation
PBWs	Bitewing radiographs
PC	platelet count
PDGF	Platelet-Derived Growth Factor
PDL	Periodontal ligament
PEB	post-eruptive enamel breakdown
PFMs	permanent first molars
pH	potential of hydrogen
PMPR	Professional mechanical plaque removal
PMRC	Polyacid modified resin composites
Pog point	Pogonion point
PPD	periodontal pocket depth
ppm	parts per million
ppm F	parts per million of Fluoride
ppm Sn	parts per million of Tin
PRF	Platelet-rich fibrin
PRGF	Plasma rich in growth factors
PT	Prothrombin time
PTT	Partial Thromboplastin time
QoL	quality of life
RA	rheumatoid arthritis

RAS	Recurrent aphthous stomatitis
RC	Resin composites
RCT	root canal treatment
RCTs	randomized controlled trials
RMGIC	Resin-modified glass ionomer cement
RPE	Rapid Palatal Expander
RR	recurrence rates
Rx	treatment
S-ECC	Severe Early childhood caries
SD	Standard deviation
SDF	Silver Diamine Fluoride
SIP	symptomatic irreversible pulpitis
SMI	Skeletal maturity indicators
SNA	Sella-Nasion-A point
SNB	Sella-Nasion-B point
SPC	supportive periodontal care
SPC	Supportive Periodontal Care
SSC	stainless-steel crown
TDIs	traumatic dental injuries
TFG	Tissular Growth Factor
TGF	transforming growth factor
TMJ	temporomandibular joint
U1-FH	Upper1 to Frankfort Horizontal
VEGF	vascular endothelial growth factor
WHO	World Health Organization
ZOE	Zinc oxide eugenol

INTRODUCTION

I. BACKGROUND

The Ministry of Health is committed to improving the health and well-being of all Cambodian population through the provision of high-quality, safe, evidence-based, acceptable, equitable and affordable healthcare services. Implementing evidence-based, appropriate, and cost-effective health interventions within care packages at various levels of the health system, guided by contextually relevant best practices in clinical practice guidelines (CPGs), can significantly enhance population health.

Clinical Practice Guidelines (CPGs) are essential tools in achieving UHC by ensuring that healthcare services are effective, safe, continuous, timely, patient-centered, and affordable. They provide evidence-based recommendations that help healthcare providers deliver high-quality care while also considering cross-cutting issues like antimicrobial stewardship to combat antimicrobial resistance. CPGs play a crucial role in ensuring the quality delivery of these defined health services at different levels of the health system. They ensure that clinical decisions are based on the best available evidence, leading to improved patient outcomes and more efficient use of resources. By adhering to CPGs, healthcare providers can offer consistent, high-quality care that meets national and international standards. Regularly reviewing and updating the CPGs will offer up-to-date, evidence-based recommendations for health services and interventions tailored to Cambodia's current and future needs.

II. DEVELOPMENT PROCESS AND METHODOLOGY

This Clinical Practice Guidelines for dental and oral health (CPG) was developed by a committee comprising Oral and maxillofacial Surgeons, Periodontists, orthodontists, pediatric dentist, endodontists, Dental Public Health Specialists and general dentists; and published by the Committee for National Medical care and Therapy of the Ministry of Health, Cambodia.

Collective of scientific evidence was performed within sub-group depend on specialties. The recommendations in this CPG were made taking into consideration both current scientific evidence as well as local circumstances. Where there was lack of or weak evidence, recommendations were made based on consensus of the group members. After development, the guidelines were scrutinized by an internal review committee who gave feedback primarily on the comprehensiveness of the guidelines and accuracy of evidences supporting the

recommendations in the guidelines. All of these were discussed during group meetings under each specialty.

Each article retrieved was appraised and assigned their evidence level according to the U.S./Canadian Preventive Services Task Force guide and the key information in each article was presented in an evidence table. Recommendations made were graded according to the Scottish Intercollegiate Guidelines Network (SIGN) guide. All statements and recommendations formulated were agreed upon by both the development group and review committee.

III.SCOPE AND END USERS

The main aim of these guidelines is to assist Medical/Dental practitioners make informed decisions on clinical treatment based on recommendations made by a systematic review of evidence and an assessment of the benefits and harms of alternative care options.

Updating the clinical practice guidelines aims to enhance both quality and coverage by providing a solid evidence-based foundation for changes in services. This includes the diagnoses, treatments, and support necessary to deliver these services as defined in the essential packages of care under the CPA guidelines.

The main end users of the CPG are clinicians, managers and other health professionals practicing in patient care settings in both private and public sectors, particularly at referral hospitals to support the delivery of consistently safe quality and cost effective and equitable health care. They should link with the CPA guidelines, IPC guidelines, AMR guidelines, Cambodian Hospital Accreditation Standards (CHAS) and Quality Enhancement Monitoring Tool (QEMT) and other MoH guidelines to motivate and facilitate their relevance and use

.

LEVELS OF EVIDENCE AND GRADES OF RECOMMENDATIONS

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 randomization
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 with or without the 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 U.S./Canadian Preventive Services Task Force

GRADES OF RECOMMENDATION

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)

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Oral and Maxillofacial surgery

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3. Acute Pain Management Following Simple or Surgical Tooth Extraction
4. Management of Unerupted and Impacted Tooth
5. Odontogenic Keratocyst (OKC)
6. Management of Post-Operative Bleeding

ANTIBIOTICS GUIDELINES IN DENTISTRY

Kor hok sim [1], Ping bushara

I. INTRODUCTION

Antibiotics are crucial in treating bacterial infections in dental practice. However, excessive and inappropriate use of antibiotics can lead to antibiotics resistance, which has become a significant global health concern. Resistance is a growing problem worldwide and can compromise the effectiveness of antibiotics, making it difficult to treat bacterial infections.

As a dentist, it is essential to understand when and how to use antibiotics by following the evidence-based guidelines. The overuse or misuse of antibiotics can lead to the evolution of antibiotics-resistant bacteria, caused more severe infection, longer hospital stays, increased health care costs, and even death. In 2023, WHO reported that 1.27 million global deaths were directly contributed to antimicrobial resistance (AMR)[1-Level III]. AMR has significant effect on economic costs. The World Bank estimates that AMR could result in US$ 1 trillion additional healthcare costs by 2050, and US$ 1 trillion to US$ 3.4 trillion gross domestic product (GDP) losses per year by 2030[2-Level III].

Antibiotics are not indicated where there is no clear sign of infection or routine dental procedures such as extraction, unless the patient has a pre-existing condition that puts them at risk of infection. Careful evaluation of each patient's condition is crucial in determining whether infection control is necessary. Alternative treatments, such as pain management and localized treatment, should be considered before prescribing antibiotics. Educating patients on what they can do to keep themselves safe is crucial to prevent antibiotic resistance.

II. INDICATION AND CONTRAINDICATION OF ANTIBIOTICS

2.1 Indication of Antibiotics

Antibiotics are generally indicated[3-Level III]

- As an adjunct to the management of acute or chronic infections **(See appendix 1 for prescription form)**
- Where definitive treatment has to be delayed, e.g. referral for specialist services for patients requiring a general anaesthetic or sedation, due to inability to

establish drainage or if patients have comorbidities requiring hospitalization. These patients should be treated as soon as possible to avoid repeat prescribing of antibiotics

- To prevent infections that may be associated with dental procedures

2.2 Contraindication of Antibiotics

Antibiotics are no indicated[3-Level III]

- In the absence of an infection or where local measures will suffice
- As prophylaxis when not indicated
- An incorrect dose or too long or short duration
- An unnecessarily broad spectrum or narrow spectrum antibiotics or wrong antibiotics for the microbiology of a specific infection
- For the treatment which is not adjusted when culture data is available
- Via IV when oral route can be used
- For a patient with a known allergy

III. PATIENT ASSESSMENT AND DIAGNOSIS

Clinical records include[3,4,5-Level III]

- A comprehensive medical and dental history
- Assessment of fever (>38°C), malaise, fatigue, dizziness (any analgesics taken)
- Measurement of patient's pulse and temperature
- The nature, location, and extent of swelling, and lymphadenopathy
- Identification of the cause of the infection
- Urgently refer to hospital specialist in case of septicemia (grossly elevated temperature > 39.5°C, lethargy, tachycardia, tachypnoea and hypotension) or signs of severe sepsis or septic shock, spreading cellulitis
- Swellings that may compromise the airway, cause difficulty in swallowing or closure of the eye through OPG or CT scan
- Dehydration characterized by lethargy, dizziness and headache
- Any trismus, dysphagia, dyspnea and dysarthria
- Failure of resolution of infection following previous treatment
- A patient who is unable to cooperate with necessary and appropriate care
- Blood tests (including blood glucose) and blood/pus cultures for sensitivity testing

Recommendation	Grade
• Antibiotics are only recommended as an adjunct to definitive treatment where there is an elevated temperature, evidence of systemic spread and local lymph node involvement. • Majority of uncomplicated dental acute infections should be treated by removal of the cause by drainage of the associated abscess, removal of infected pulp or by extraction of the tooth.	C

Key messages

The patient should be referred to the hospital specialist urgently particularly if

- Signs of septicemia, such as grossly elevated temperature (above 39.5°C), lethargy, tachycardia, tachypnoea and hypotension
- Signs of severe sepsis or septic shock
- Spreading cellulitis
- Swellings that may compromise the airway, cause difficulty in swallowing or closure of the eye
- Dehydration characterized by lethargy, dizziness and headache
- Significant trismus associated with a dental infection
- Failure of resolution of infection following previous treatment
- A patient who is unable to cooperate with necessary and appropriate care

IV. ANTIBIOTICS FOR ACUTE DENTO-ALVEOLAR INFECTION

4.1 Acute periapical infections[3, 4, Level III]

Acute periapical infections are infections around the apex of the tooth associated with tooth decay or trauma causing necrosis of the dental pulp. There is associated pain, swelling (localized or spreading), tenderness of the tooth to percussion and mobility, possible raised temperature, malaise, lymphadenopathy and possible dehydration.

4.1.1 First Choice Antibiotics

Penicillin, such as phenoxymethylpenicillin or amoxicillin, is effective for dentoalveolar infections[3, Level III].

PHENOXYMETHYLPENICILLIN
Adults • 500mg orally four times a day, increased if necessary to 1g every 6 hours for up to 5 days **Children** • 1-5 years: 125mg orally four times a day, increased if necessary up to 12.5mg/kg (4 times a day for up to 5 days) • 6-11 years: 250mg orally four times a day, increased if necessary up to 12.5mg/kg (4 times daily for up to 5 days) • 12-17 years: 500mg orally four times a day, increased if necessary up to 1g every. 6 hours for up to 5 days

AMOXICILLIN
Adults • 500mg orally three times a day for up to 5 days, increased if necessary to 1g every 8 hours in severe infections **Children** • 1-4 years: 250mg orally three times a day, increased if necessary up to 30mg/kg (3 times a day for up to 5 days) • 5-11 years: 500mg orally three times a day, increased if necessary up to 30mg/kg. [3 times a day (max. per dose 1g) for up to 5 days] • 12-17 years: 500mg orally three times a day, increased if necessary up to 1g (3 times a day for up to 5 days)

4.1.2 Second Choice Antibiotics

Metronidazole can be used[3, Level III]:

- As a first line treatment for patients allergic to a penicillin;
- As a first line treatment for patients who have had a recent course of a penicillin for another infection
- As an adjunct to a penicillin in severe spreading infections
- If a predominantly anaerobic infection is suspected or microbiologically proven

METRONIDAZOLE
Adults • 400mg orally three times a day for up to 5 days **Children** • 1-2 years: 50mg orally every 8 hours for up to 5 days • 3-6 years: 100mg orally every 12 hours for up to 5 days • 7-9 years: 100mg orally every 8 hours for up to 5 days • 10-17 years: 200-250mg orally every 8 hours for up to 5 days

Clarithromycin can be used[3, Level III]:

• As a first line treatment for patients allergic to a penicillin

• As a first line treatment for patients who have had a recent course of a penicillin

CLARITHROMYCIN
Adults • 250mg orally twice a day for up to 5 days, increasing to 500mg twice a day in severe infections **Children** • 1 month-11 years (body-weight 12-19kg): 125mg orally twice a day up to 5 days • 1 month-11 years (body-weight 20-29kg): 187.5mg orally twice a day up to 5 days • 1 month-11 years (body-weight 30-40kg): 250mg orally twice a day up to 5 days • 12-17 years: 250mg orally twice a day for up to 5 days, increasing to 500mg twice a day in severe infections

4.1.3 Other Alternative Choices of Antibiotics

CLINDAMYCIN

Adults

- 150-300mg orally four times a day increased if necessary to 450mg every 6 hours in severe infections for up to 5 days

Children

- 3-6mg/kg orally 4 times a day (max dose 450mg) for up to 5 days

CO-AMOXICLAV

Adults

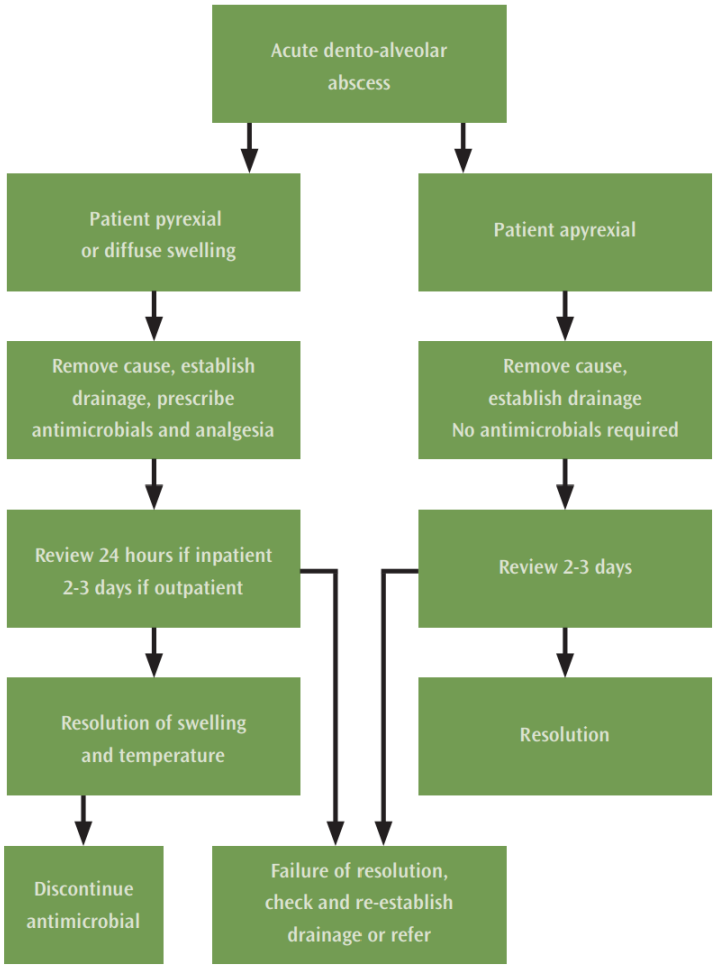
- 500/125mg orally every 8 hours for severe infections for 5 days

Children

- 12-17 years: 500/125mg orally every eight hours for severe infections for 5 days

Recommendation	Grade
The routine prescribing of clindamycin, cephalosporins or co-amoxiclav for dental infections is not recommended and should only be at the direction of a specialist in oral/medical microbiology or infectious diseases.	C

4.1.4 Algorithm[3, Level I]



4.2 Severe rapidly spreading dento-facial abscesses, cellulitis, and Ludwigs's angina

When an abscess spreads rapidly beyond the dento-alveolar area into the surrounding tissue with systemic signs and symptoms, it can be life-threatening and require urgent surgical intervention and intensive care management because of the potential for spread of infection into intracranial and peri-tracheal neck spaces and the risk of airway compromise if appropriate management is not instituted[5, Level III].

Recommendation	Grade
When an abscess spreads rapidly beyond the dento-alveolar area into the surrounding tissues with systemic signs and symptoms, management usually requires hospital admission due to the possibility of severe complications.	C

V. ANTIBIOTICS FOR CHRONIC DENTAL INFECTION

Chronic dento-alveolar infections occur as a result of decayed or restored teeth, or periodontal-endodontic lesions with a longstanding minor well-localized abscess contained by the host immune system. These infections sometimes spontaneously drain through a sinus tract which can be either intra- or extraoral.

It is generally accepted that definitive dental treatment to remove the cause leads to resolution. Case reports and a review of the literature show that removal of the cause of the infection normally resolves the infection and extraoral cutaneous sinus tracts heal spontaneously[6, Level II-2].

Recommendation	Grade
Antibiotics are not required for chronic dento-alveolar infection unless: • There is an acute flare-up and there is evidence of severe local spread, or • There is systemic involvement shown by raised temperature and malaise	C

Longstanding chronic infections that fail to respond to treatment are indicative of a more serious problem, e.g. **Osteomyelitis, Medication Related Osteonecrosis of the Jaw (MRONJ), and Osteoradionecrosis (ORN)**. **These patients should be referred for specialist management.**

VI. ANTIBIOTICS FOR PERICORONITIS

Pericoronitis is inflammation and infection of the soft tissues around a partially erupted tooth, usually an impacted mandibular third molar. Local inflammation and infection are managed with local measures, such as removal of the cause (extraction or operculectomy), incision and drainage where necessary[7, Level I].

Recommendation	Grade
Antibiotics are only recommended for pericoronitis as an adjunct to local measures where there is evidence of systemic spread (elevated temperature), severe generalized swelling, cellulitis or severe localized swelling and trismus.	A

5.1 Antibiotics drug choices[7, Level I]

METRONIDAZOLE

Adults

- 400mg orally three times a day for up to 5 days

Children

- 10-17 years: 200-250mg orally every 8 hours for up to 5 days

AMOXICILLIN

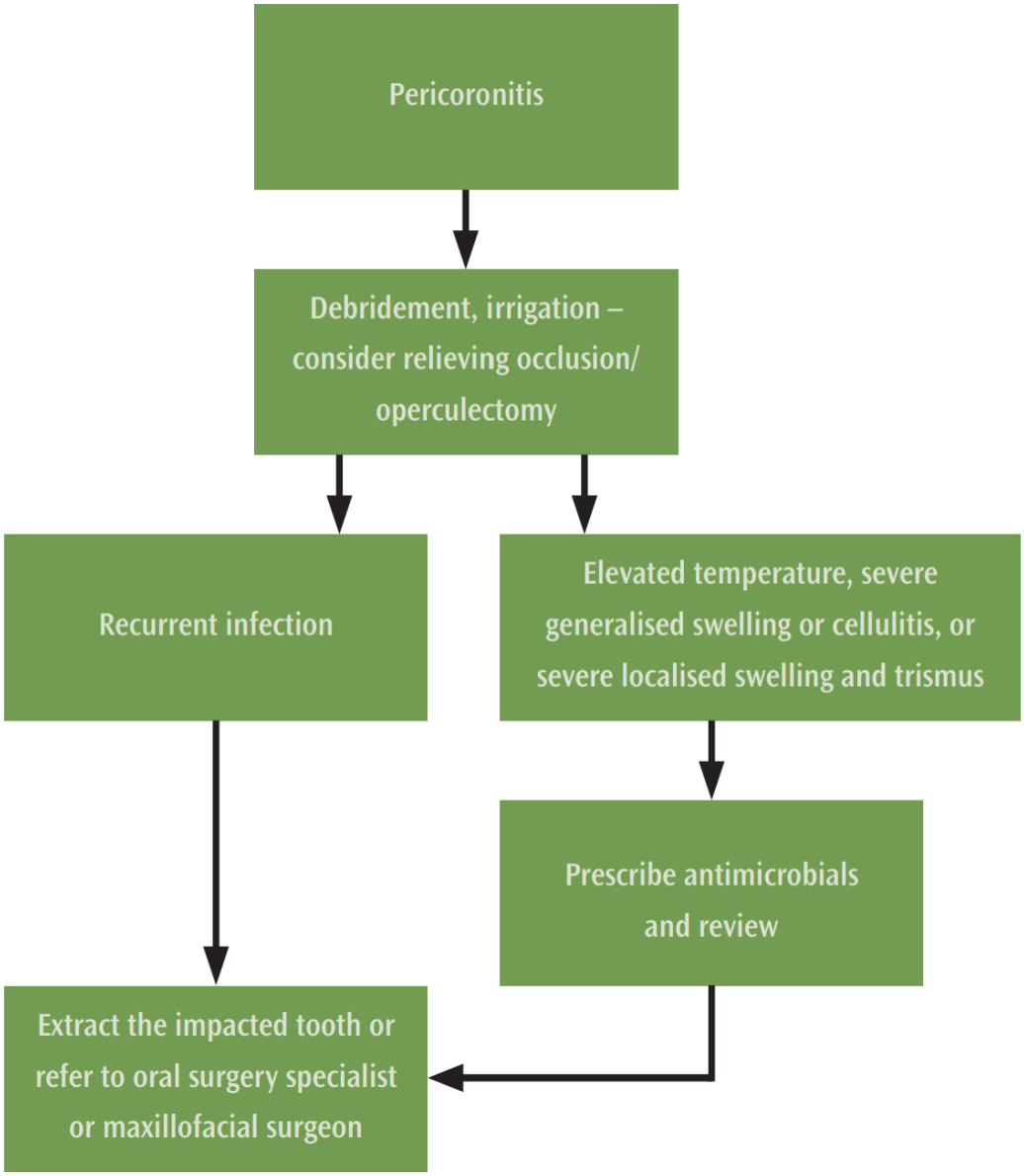
Adults

- 500mg orally three times a day for up to 5 days increased if necessary to 1g every 8 hours in severe infections

Children

- 12-17 years: 500mg 3 times a day, increased if necessary up to 1g 3 times a day, use increased dose in severe infections

5.2 Algorithm[3, Level I]



VII. ANTIBIOTICS FOR DRY SOCKET

Dry socket or localized osteitis is a recognized complication following tooth extraction. It occurs

3-4 days post-extraction and is self-limiting, lasting for up to 10 days. The etiology is thought to be associated with surgical trauma, local infection, inadequate oral hygiene and poor aftercare[3, Level III].

There are no RCTs comparing clinical outcomes of prescribing antimicrobials against no antimicrobials in the management of dry socket. In the absence of signs of a spreading infection,

it is generally accepted that antimicrobials are contraindicated and management is centered around local measures[8, Level I].

Recommendation	Grade
Antibiotics are not recommended for the management of dry socket in the absence of signs of a spreading infection.	C

VIII. ANTIBIOTICS FOR SINUSITIS

8.1 Signs and symptoms[3, Level III]

- Nasal discharge
- Nasal blockage or congestion
- Facial pain localized over the affected sinus that can affect the teeth, upper jaw or eye, side of the face or forehead. Pain in the absence of other symptoms is unlikely to be sinusitis and a dental cause should be ruled out
- Loss or altered sense of smell

Recommendation	Grade
Antibiotics are recommended for acute sinusitis, sub-acute sinusitis, recurrent sinusitis, and chronic sinusitis with the removal of causes in case of odontogenic origin[9, Level I].	A

8.2 Antibiotics drug choices[9, Level I]

AMINOPENICILLINS COMBINES WITH B-LACTAMASE INHIBITORS
Adults • 875 mg amoxicillin and 125 mg clavulanic acid at least 7 days or up to 28 days after the resolution of symptoms.

Cephalosporins
can be used as an alternative but less effective against anaerobic bacteria and cross allergies.

Trimethoprim/Sulfamethoxazole combination
can be used for patients allergic to Penicillin.

Recommendation	Grade
Sinusitis patients should be referred for specialist management.	A

IX. ANTIBIOTICS FOR BACTERIA SIALADENITIS

Sialadenitis is inflammation and swelling of the parotid, submandibular, sublingual or minor salivary glands.

9.1 Acute bacterial sialadenitis

Acute bacterial sialadenitis is characterized by[3, Level III]:

- Rapid onset of pain
- Swelling and elevated temperature
- Cellulitis and induration of the adjacent soft tissues may be present, and rarely a cutaneous fistula
- Exudates of pus from salivary gland opening

9.2 Chronic sialadenitis

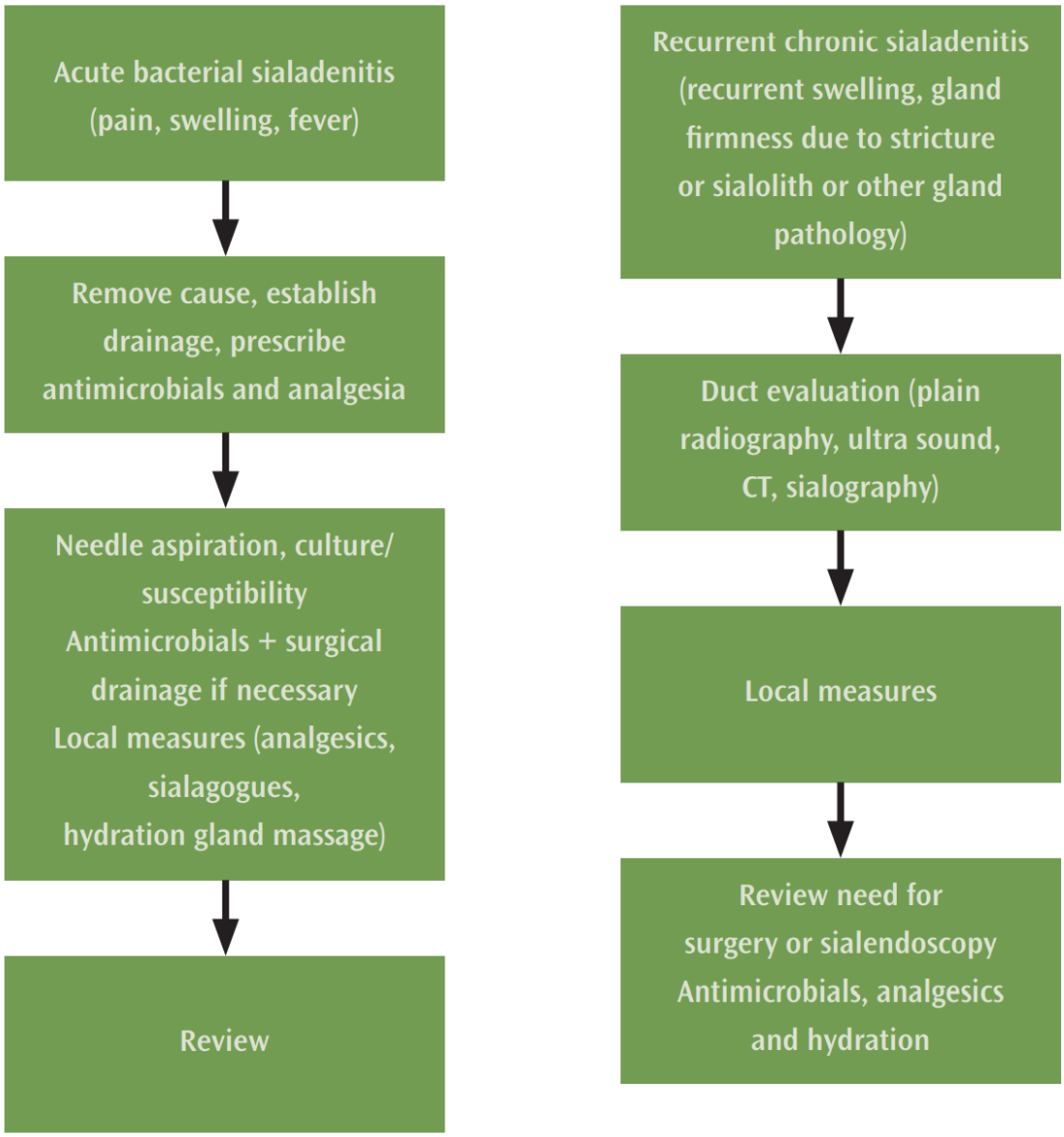
Chronic sialadenitis is characterized by intermittent, recurrent episodes of tender swelling, usually as a result of obstruction (stricture or calculus) of the duct which can be managed with local measures.

Recommendation[10, Level I]	Grade
• Antibiotics with local measures (hydration, sialagogues, gland massage, warm compress, and oral hygiene instruction) are recommended for acute bacterial sialadenitis • Antibiotics are not recommended for chronic sialadenitis which can be managed with local measures • Refer to specialist management of acute bacterial sialadenitis with systemic signs and symptoms	C

9.3 Antibiotics drug choice[10, Level I]

CO-AMOXICLAV
Adults • 875 mg of amoxicillin and 125 mg of clavulanate orally twice a day for 2 weeks If no improvement, refer to hospital for specialist treatment.

9.4 Algorithm[3, Level I]



X. ANTIBIOTICS FOR PERIODONTAL DISEASES

10.1 Gingivitis[3, Level III]

Recommendation	Grade
Antibiotics are not recommended for gingivitis.	C

10.2 Necrotizing Periodontal Diseases[3, Level III]

These are rare and include necrotizing gingivitis, necrotizing periodontitis and necrotizing stomatitis. They are characterized by gingival necrosis and bleeding, pain and fetid breath. In severe cases, systemic signs and symptoms, such as lymphadenopathy, fever, and malaise maybe present.

Recommendation	Grade
Antibiotics are recommended only as an adjunct to local measures for necrotizing periodontal disease where there is evidence of systemic involvement.	C

Antibiotics drug choices

METRONIDAZOLE
Adults • 400mg orally three times a day for up to 5 days **Children** • 10-17 years: 200-250mg orally every 8 hours for up to 5 days

OR AMOXICILLIN
Adults • 500mg orally three times a day for up to 5 days increased if necessary to 1g every 8 hours in severe infections **Children** • 12-17 years: 500mg 3 times a day for up to 5 days, increased if necessary up to 1g 3 times a day, use increased dose in severe infections

10.3 Periodontitis[3, Level 1II]

The recent reclassification of periodontitis is based on staging (initial [I], moderate [II], severe[III], very severe [IV]) in terms of interproximal bone loss and grading (slow [A], moderate [B], rapid [C]) progression in terms of percentage bone loss compared to patient age.

Patients with severe/very severe or rapidly progressing forms of periodontitis responding poorly to effective mechanical debridement and excellent patient oral hygiene should be referred for specialist management.

10.3.1 Stage I, II, III; Grade A, B periodontitis or periodontitis in any patient aged >40-45years[3, Level 1II]

Recommendation	Grade
Antibiotics are not recommended as an adjunct to thorough and effective mechanical debridement for patients with periodontitis of slow or moderate progression, or in any patient with periodontitis aged >40-45 years.	C

10.3.2 Stage III, IV periodontitis Grade C in patients aged <40-45years[3, Level 1II]

Recommendation	Grade
Antibiotics are only recommended as an adjunct to effective mechanical debridement, oral hygiene instruction and management of modifiable risk factors in patients aged <40-45years with rapidly progressing periodontal disease.	C

10.3.2.1 First Choice Antibiotics[3, Level 1II]

AMOXICILLIN
Adults and children 10-17 years • 500mg orally three times a day for up to 5 days

OR METRONIDAZOLE
Adults and children 10-17 years • 400mg orally three times a day for up to 5 days

10.3.2.2 Second Choice Antibiotics[3, Level 1II]

AZITHROMYCIN
Adults • 500mg orally once a day for 3 days **Children** • 12-17 years (body weight 36-45kg): 400mg orally once a day for 3 days • 12-17 years (body weight 46kg and over): 500mg orally once a day for 3 days

10.3.2.3 Other Antibiotics[3, Level 1II]

DOXYCYLINE
Adults and children 12-17 years • 100mg orally twice a day for the first day then once a day for up to 5 days

10.4 Periodontal Abscess[3, Level 1II]

Recommendation	Grade
Antibiotics are only recommended as an adjunct to definitive treatment for periodontal abscesses where there is an elevated temperature, evidence of systemic spread and local lymph node involvement.	C

10.5 Peri-implant Diseases[3, Level 1II]

Recommendation	Grade
• Antibiotics are not recommended for peri-implant mucositis, local measures to improve self-performed oral hygiene are the treatment of choice. • Antibiotics are not recommended as an adjunct to local management of peri-implantitis.	C

XI. ANTIBIOTICS FOR ENDODONTIC THERAPY[3, Level 1II]

Recommendation	Grade
• Antibiotics are not recommended for most endodontic treatment. • Antibiotics are not recommended for acute pulpitis to prevent pain associated with pulpitis. • Antibiotics are not recommended to prevent postoperative pain, swelling or endodontic flare-ups. • Antibiotics are not recommended for regenerative endodontic procedures (REPs). • Antibiotics are not recommended for peri-radicular surgery in the absence of systemic infection. • Antibiotics may or may not be recommended as an adjunct to local management for pulp necrosis and localized acute apical abscess; however, antibiotics are recommended as an adjunct to local management for pulp necrosis and localized acute apical abscess with systemic involvement[9, Level 1].	C

Antibiotics of Choice
AMOXICILLIN • 500mg orally three times a day for 3-7 days Or **PENICILLIN V POTASSIUM** • 500mg orally four times a day for 3-7 days

XII. ANTIBIOTICS PROPHYLAXIS- HEALTHY PATIENTS

12.1 Minor oral surgery[3, Level 1II]

Recommendation	Grade
Antibiotics prophylaxis is not recommended to prevent postoperative complications after peri-radicular surgery, minor surgical removal of soft tissue lesions, extraction of impacted wisdom teeth, surgical extractions of teeth or retained roots, and all minor surgeries.	C

12.2 Oral antral communications (OAC) [3, Level 1II]

Recommendation	Grade
• Antibiotics prophylaxis is recommended to prevent acute sinusitis as a result of an oral antral communications (OAC). • Large acute OACs and cases where root or root fragments have been introduced into the sinus require immediate referral and specialist management within 48 hours.	C

Antibiotics drug choices

PHENOXYMETHYLPENICILLIN
Adults • 500mg orally four times a day for up to 5 days **Children** • 12-17yrs: 500mg orally four times a day for up to 5 days

Penicillin allergy
DOXYCYCLINE **Adults** • Initially 200mg orally 1 dose for one day, then maintenance 100mg once a day for 4 days **Children** • 12-17 years: Initially 200mg orally 1 dose for one day, then maintenance 100mg once a day for a further 4 days Or **CLARITHROMYCIN** **Adults** • 500mg orally twice a day for up to 5 days **Children** • 12-17yrs: 500mg orally twice a day for up to 5 days

12.3 Dental Implant

In 2023, the systematic review and meta-analysis of antibiotic use in dental implant procedures stated that the routine use of prophylactic antibiotics to prevent infection in dental implant placement was found to be not sufficiently effective to justify routine use. Clear clinical assessment pathways, such as those used for medical conditions, based on the patients' age, dental risk factors, such as oral health and bone health, physical risk factors, such as chronic or long-term conditions and modifiable health determinants, such as smoking, are required to prevent the unnecessary use of antibiotics[11, Level I].

Recommendation	Grade
• Antibiotics prophylaxis is not routinely recommended for placing dental implants without bone graft. • Antibiotics prophylaxis is recommended for placing dental implants with bone graft[12, Level I].	A

Antibiotics drug choices

AMOXICILLIN
Adults • 2-3g orally one hour before surgery[3, Level III; 12, Level I]

CLINDAMYCIN
Adults • 600mg orally (4x150mg) one hour before surgery

12.4 Reimplantation of Avulsed Teeth

The result from systematic review and meta-analysis concluded that there was no clinical evidence clearly contradicting or supporting existing guidelines. Also, there was no significant association between prescribing systemic antibiotics and improved pulp or periodontal outcomes[13, Level II-2].

Recommendation	Grade

Antibiotics prophylaxis is not routinely recommended for the avulsed tooth in a healthy patient.	**A**

XIII. ANTIBIOTICS PROPHYLAXIS- MEDICALLY COMPROMISED PATIENTS

13.1 Infective endocarditis (IE)

Recommendations for antibiotic prophylaxis in patients with cardiovascular diseases undergoing oro-dental procedures at increased risk of infective endocarditis (IE)[14, Level III]

Recommendation	Grade
• Antibiotic prophylaxis is recommended in patients with previous IE. • Antibiotic prophylaxis is recommended in patients with surgically implanted prosthetic valves and with any material used for surgical cardiac valve repair. • Antibiotic prophylaxis is recommended in patients with transcatheter implanted aortic and pulmonary valvular prostheses. • Antibiotic prophylaxis should be considered in patients with transcatheter mitral and tricuspid valve repair. • Antibiotic prophylaxis is recommended in patients with untreated cyanotic CHD, and patients treated with surgery or transcatheter procedures with postoperative palliative shunts, conduits, or other prostheses. After surgical repair, in the absence of residual defects or valve prostheses, antibiotic prophylaxis is recommended only for the first 6 months after the procedure.	**C**

13.2 Total joint replacements

A systematic review explored the risk of dental interventions and subsequent artificial joint infection found no evidence that the use of antimicrobial prophylaxis reduces the incidence of joint infection; however, **it is advisable to consider premedication in a small number of patients who may be at potential increased risk of experiencing hematogenous total joint infection**.[15, Level III].

Recommendation	Grade
Antibiotic prophylaxis is not recommended for dental procedures in patients with joint replacements.	**C**

13.3 Miscellaneous prosthetic implants

There is no strong evidence to support that the patients who have undergone penile, breast, cardiac pacemakers or intraocular implants are susceptible to dental procedure based infection[16, Level III].

Recommendation	Grade
Antibiotic prophylaxis is not recommended for dental procedures in patients with cardiac pacemakers, penile, breast or intra-ocular implants.	C

13.4 Renal dialysis

There is no clear evidence of metastatic infections resulting from dental procedures in patients receiving renal dialysis, despite patients with end stage renal disease (ESRD) also having complications, including increased cardiovascular risk, cardiogenic pulmonary oedema[17, Level I].

Recommendation	Grade
Antibiotic prophylaxis for patients undergoing renal dialysis is not normally recommended for dental procedures (only recommended for invasive dental procedures).	C

13.5 Intravenous access devices

There is no scientific evidence of infection of these devices arising in patients with central intravenous lines/indwelling catheters used for parenteral nutrition or chemotherapy, and catheters for haemodialysis[18, Level I].

Recommendation	Grade
Antibiotic prophylaxis is not required for dental procedures in patients with intravenous access devices.	C

13.6 Immunocompromised patients

Recommendation[3, Level III]	Grade
• Antibiotic prophylaxis is not recommended routinely for diabetic patients undergoing dental procedures • Antibiotic prophylaxis is not routinely recommended for HIV patients undergoing dental procedures • Antibiotic prophylaxis is not normally recommended for patients undergoing chemotherapy • Antibiotic prophylaxis may be recommended for dental extractions following an assessment of the risk of developing osteoradionecrosis (ORN). • Antibiotic prophylaxis is not routinely required for patients with solid organ transplants prior to interventive dental procedures. • Antibiotic prophylaxis is not routinely recommended for patients with haemopoietic or lymphoid tumors. • Antibiotic prophylaxis is not recommended for dental procedures to prevent medication related osteonecrosis of the jaw (MRONJ).	C

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DRY SOCKET (ALVEOLAR OSTEITIS)

Khorn Sophea, Ouk Darin, Hou Sokuntheary, Cheang Mengchou,
Voeung Chhorlady,Taing Valdeth, Heng Sothiro

I. INTRODUCTION

Dry socket, also termed fibrinolytic osteitis or alveolar osteitis, is one of the most common postoperative complications after surgical removal of a tooth or tooth extraction occurring three to five days after an extraction and it is a very painful inflammatory condition that has the characterize by dull aching radiating pain which may reach the ocular and temporal region [1, 26 Level III; 6 Level I]. The incidence of dry socket is approximately 3% for all routine dental extraction and can exceed 30% for removal of mandible third molars [2,6,11 Level I; 13,1619 Level II-2] or it can reach up to 38%[4,15 Level II-3]. The mandible was involved three times more than the maxilla[9 Level II; 13 Level II-2].

II. CASE DEFINITION

Dry socket is a complication of tooth extraction and it is described the present of postoperative pain in and around the extraction site, which increases in severity at any time between 24 hours and 72 hours after the extraction, accompanied by a partially or totally disintegrated blood blot within the alveolar socket, with or without halitosis and also known for its dry appearance to the socket [1,21 Level III; 2,6 Level I; 4,15Level II-3]. Some other terminologies for dry socket are alveolitis sicca dorosa, necrotic socket, fibrinolytic alveolitis, septic socket, alveolalgia, localized osteomyelitis, localized alvelitis[26 level III; 32 Level I].

III. ETIOLOGY

The exact etiology of dry socket still remains largely unknown, but the most widely accepted theory is that it is the result of a partial or complete disintegration of formed blood clots by fibrinolysis[2,10 Level I; 17-19 Level II-2; 26-27 level III]. However, the study shown that the bacteria are cited to play a role in the breakdown of the clot and also has many factors that can cause alveolar osteitis[15 Level II-3; 23 Level II].

- Risk factors associated with dry socket such as:
  - previous experience of dry socket[1,4 Level II-3],
  - pre-existing infection[2 Level I; 5,19 Level II-2;

- Tobacco use[2,8,11,31 Level I; 17-19,24 Level II-2](smokers 12%, non-smokers 4%[26 Level III])
- Female gender[2,8 Level I; 18 Level II-2] (dry socket Female:Male ratio was 6:1[23 Level II]).
- Age [17-19 Level II-2] (>25-year-old),
- poor oral hygiene [4 Level II-3; 19 Level II-2; 21-21,25-26 Level III],
- oral contraceptive use[2 Level I; 25 Level III],
- antibiotic use[4 Level II-3; 5 Level II-2; 8,11 Level I,
- systemic disorder[4 Level II-3],
- deeply impacted mandibular third molar[4 Level II-3].
- Traumatic extractions[2 Level I; 5] or difficulty extraction[17,24 Level II-2],
- unexperienced dentist[4Level II-3;17,18 Level II-2; 25-26 Level III],
- and/or the use of local anesthetics with vasoconstrictors[4,15 Level II-3; 32 Lvel I], the study found that " dry socket was more prevalent where prilocaine (Citanest) with 1:200,000 epinephrine was used versus lidocanine (Xylociane) with 1:100, 000 epinephrine" [24 LevelII-2]

IV. DIAGNOSIS

KEY MESSAGE
Evaluation of periodontal status requires relevant information on:
- History taking
- Clinical examination
- Investigation

1. History taking

- Medical and dental history
  - To identify pre-disposing conditions such as: smoking, traumatic extraction, female gender, presence of pericoronitis, length of surgery, surgical trauma[1,4 level II-3; 2 level I; 12 Level II-2].
  - Chief complaint, history of complaint or reason for the visit such as: painful three days to 5 days after extraction tooth or surgery, bad breath, bad taste in mouth[1,4 level II-3; 12,18 Level II-2].

2. Clinical examination

- Signs and symptoms:

- Painful within 24 hours to 72 hours after extraction [2,11 Level I], lasts10-15days[34 level II-2] (or lasts for 5-10 days[11 Level I; 18 Level II-2; 21 Level III])
- Blood clot in socket breaks down (empty socket), exposing bone [2 Level I]
- A mixture of food debris and saliva may fill the socket [4,15 Level II-3]
- A gray-brown blot, or the complete absence of an organized clot, may be present in the extraction socket[1,15 Level II-3; 12 Level II-2]
- Soft tissue surrounding socket may be erythematous (redness), inflammation, tenderness and edematous[1,4,15 level II-3; 12,18 level II-2]
- The site is exquisitely tender to palpation and often patients will have referred pain to other areas of the head and neck, including the ear, eye, or temporal and frontal regions. [1 Level II-3; 12 Level II-2]
- Constant severe radiating pain, bad breath, bad taste in mouth[1,15 Level II-3; 5,12 Level II-2]
- There is generally no suppuration, swelling or signs of systemic infection such as a fever or systemic upset.[4,15 Level II-3]

Figure 1: alveolar bone exposition/ socket empty[1 Level II-3]

3. Investigation

Radiograph should be taken to eliminate the possibility of retained root or bony fragments as a source of the pain.[15 Level II-3]

4. Differential diagnosis

- Osteomyelitis,
- Subperiosteal infection,
- And bony sequestra formation[3,25 Level III].

5. Prognosis

Alveolar osteitis is self-limiting, the prognosis is excellent. it will resolve within days after initiating treatment[25 Level III]. Even without treatment, the course will be short, and it does not cause any long-term morbidity[3 Level III].

V. MANAGEMENT

Alveolar Osteitis is a self-healing condition and there is no established treatment for alveolar Osteitis[10 Level I; 15 Level II-3]. The management of Alveolar Osteitis is more about symptom relief (pain) rather than particular disease process.[10 Level I]

1. Treatment

- Flushing out the socket: Removal of debris from the socket by irrigation with saline, sterile local anaesthetic[5,17 Level II-2]; or with sterile saline, rifampicin, clindamycin[13 Level II-2; 31 Level I]
- Dressing with medicine (see appendix1:Table1): The placement of intrasocket medicaments including antibacterials, topical anaesthetics and obtundents or combinations of all three[5 Level II-2 ; 15 Level II-3]. The intrasocket medication including: zinc oxide and eugenol impregnated colon pellets, alvogy (eugenol, iodonform and butamen), dentalone, bismuth subnitrate and iodoform paste (BIPP) on ribbon gauze and metronidazole and lidocaine ointment[5,12 Level II-2,15 Level II-3; 32 Level I].
- Pain medicine (e.g. Paracetamol) and self-care

2. Medication and Instrumentation Need

- Paracetamol
- Large syringe for irrigation, filled with warm sterile normal saline (cold will cause pain)
- Suction equipment or cup and tissues to spit into

- Sterile cotton gauze
- Sterile retractor, helper to retract tongue
- Sterile dental mirror
- Sterile Tweezers
- Pinch of dry socket dressing e.g. Alvogyl (widely used)[5 Level II-2]

3. Procedure

- Give pain relief first[32 Level I] (e.g. paracetamol)
- Sit patient in comfortable chair
- If necessary, local anesthetic may be used in severe cases[15 Level II-3]
- Use syringe to gently wash (irrigate) socket with normal saline[4 Level II-3, 13 Level II-2]
  - have patient spit it out or use suction
- Dry area with gauze (keeps the socket clean)[4 Level II-3]
- Place an alveogyl dressing loosely into the socket dressing[15 Level II-3; 17 Level II-2]
  - Tell patient it will smell and may tasted bad, but they will feel a lot better
- Tell patient to use warm salt-water or chlorhexidine mouthwash morning, night after food for one week[18 Level II-2]
- Check every 2-3 days. Repeat wash out, put in fresh dry socket dressing
- Tell patient dressing can be left in place.

Figure 2: Dry socket lesion and packing with an iodoform paste[1 Level II-3]

Figure 3: Clinical presentation of the dry socket after 24 hours of extraction of lower right third molar [19 Level II-2].

Figure 4: Clinical presentation of the soft tissues of the lower right posterior region after healing of the dry socket[19 Level II-2].

4. Prevention

There have been a number of theories as to the etiology of dry socket and a range for preventative agents have been advocated according to the prevailing theory of causation at the time including:

- Plaque control[18 Level II-2; 21-22 Level III]
- Antiseptic rinses [15 Level II-3;18,24 Level II-2]
- Preoperative systemic antibiotics[15 Level II-3;18 Level II-2]
- Direct placement of medicaments into the socket[3 Level III; 24 Level II-2]

Use antiseptic chlorhexidine rinses pre and post-operative can be effective in reducing the incidence of dry socket[3, 21-22 Level III; 15 Level II-3;18 Level II-2]. Surgical techniques (such as surgical drains, wound irrigation and different flap designs) for prevention dry socket[3,28-30 Level III]

5. Recommendation to prevent dry socket[4 Level II-3]

- Use of good quality current preoperative radiographs
- Careful planning of the surgery
- Use of good surgical principles
- Extractions should be performed with minimum amount of trauma and maximum amount of care

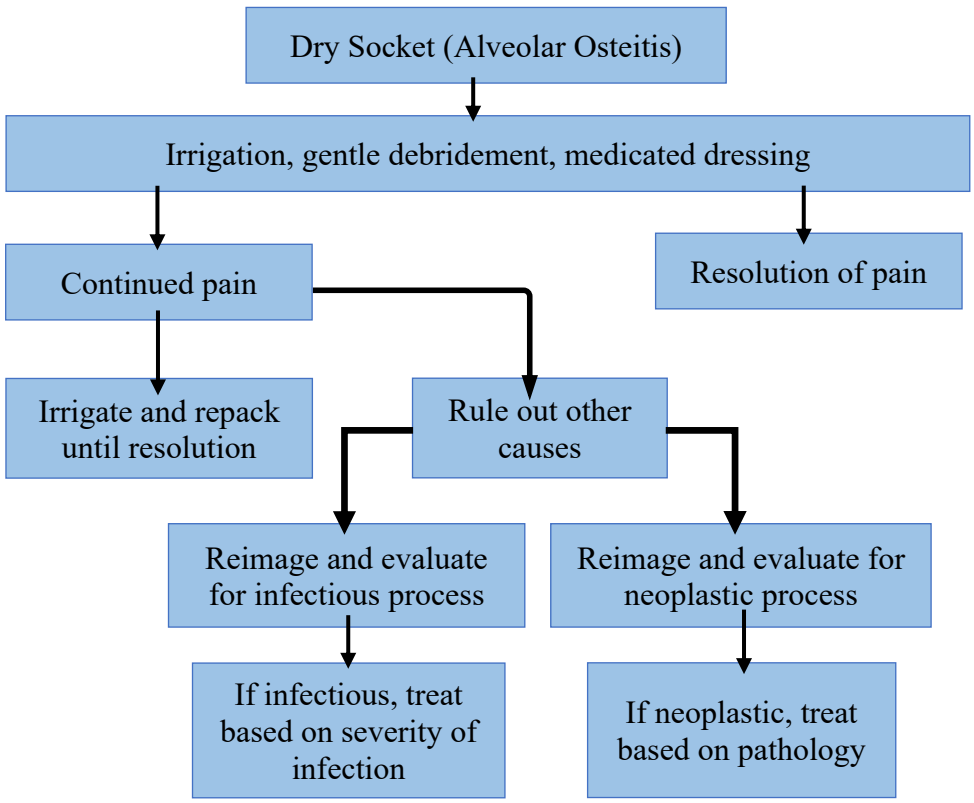
- Confirm presence of blood clot subsequent to extraction (if absent, scrape alveolar walls gently)
- Wherever possible preoperative oral hygiene measures to reduce plaque levels to a minimum should be instituted
- Encourage the patient (again) to stop or limit smoking in the immediate postoperative period
- Advise patient to avoid vigorous mouth rinsing for the first 24 hours post extraction and to use gentle toothbrushing in the immediate postoperative period
- For patient taking oral contraceptives extractions should ideally be performed during days 23 through 28 of the menstrual cycle.
- Comprehensive preoperative and postoperative verbal instructions should be supplemented with written advice to ensure maximum compliance.

RECOMMENDATION

No smoking for at least 48 hours and uses of a 0.12% chlorhexidine rinse for one week of post extraction tooth has been to reduce the incidence of dry socket.

Grade C

VI. ALGORITHM FOR MANAGEMENT OF DRY SOCKET



VII. APPENDICES

Appendix 1

Table 1: Different methods in the management of dry socket	
Method	Features
Zinc oxide eugenol (ZOE)[32 Level I]	• Gausze or ointment formulation. Antiseptic and anesthetic properties, as it depresses sensory receptors involved in pain perception • contains eugenol, which has a more potent analgesic, sedative and anodyne effects compared to alvogyl as well as having antibacterial properties.
Alvogyl[32 Level I]	• Is an alveolar hemostatic-analgesic paste with a fibrous consistency and good adhesion form the Penghawar fiber. • (Septodont, Cambridge, Canada). Includes eugenol as an analgesic, iodoform as an antimicrobial and butamen as anesthetic.
GECB Pastille [32 Level I; 33Level II-1,34 Level II-2]	• (Sultan company, Kuwiat). Includes 3% Guaiacol, 3% Eugenol, 1.6% Chlorobutano.
Vitamin C	• Tablet formulation. Wound healing promoter and antio□idant action that reduces infection and inflammation.
SaliCept Patch [32 Level I]	• (Carrington Laboratory, Irving, USA). Contains Acemannan hydrogel, obtained from the clear inner gel of Aloe Vera, which promotes wound healing, augments reticuloendothelial function, regulates the immune response and acts as an anti-inflammatory and antibacterial agent.
Plasma rich in growth factors (PRGF)	• Contains platelets and fibrinogen, so it promotes wound healing as well as osteogenesis. Platelet-derived Growth Factor (PDGF) and Tissular Growth Factor (TFG) are some of the Growth Factors in this plasma.
Topical anesthetic gel Oraqix	• (Dentsply Pharmaceutical, York, USA). Contains 2.5% prilocaine, 2.5% lidocaine, thermosetting agents,

	hydrochloric acid and purified water. Antiseptic and anesthetic properties.
Low level laser therapy (LLLT)[20,32] **Level I**	• (Lambda Laser Products, Vicenza, Italy). Antimicrobial potential and increases the speed and quality of wound healing. 808 nm, 100-mW continuous mode gallium aluminium arsenide diode laser.

RECOMMENDATION

LLLT applied to dry socket the result was similar to GFS (growth factor stimulation), but more effective than Alvogyl, and SaliCept patch.

Grade C

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ACUTE PAIN MANAGEMENT FOLLOWING SIMPLE OR SURGICAL TOOTH EXTRACTION

CHEANG Pengleang; KOR Hok Sim; PHAN Sandeth

I. INTRODUCTION

When choosing an analgesic regimen for acute dental pain management following simple or surgical tooth extraction, consider the severity of the patient's pain and patient factors that may influence analgesic choice (Table 1). There are 3 categories of analgesic: Paracetamol, NSAIDs, and Opioid. Care should be taken to avoid prescribing analgesics more than one drug from each category as there is no clinical benefit and will overdose the patient. However, combining analgesics from different categories can result in enhanced pain management, or synergistic analgesia (e.g., combining ibuprofen and paracetamol provides greater pain relief than either drug alone) [1 Level I].

Table 1: Factors influencing the choice of analgesics for acute postoperative pain following simple or surgical tooth extraction [1 Level I]

• Is the pain mild, moderate or severe? Pain severity determines the most suitable analgesic regimen. When assessing pain severity, consider both patient-reported pain severity and the expected pain severity based on the cause of pain.
• Consider potential adverse effect, and contraindications or precautions to analgesic use. These factors may influence analgesic choice. (See Table 2, 3 & 4; Box 1 & 2)
• Can the patient take medications orally? Oral administration is preferred. If this is not possible (i.e., if the patient has difficulty swallowing or gastrointestinal absorption is likely to be significantly reduced), consider suppositories or injections.

A. Analgesic categories and its adverse effect, and contraindications or precautions

1) Nonsteroidal anti-inflammatory drugs - NSAIDs

Although **nonsteroidal anti-inflammatory drugs (NSAIDs)** are preferred for acute postoperative dental pain because they are anti-inflammatory, their adverse effect profile limits their use in some patients. Before prescribing an NSAID for a patient, determine whether NSAID use is appropriate based on their comorbidities and risk factors. If NSAID use is appropriate, ibuprofen is preferred because of good efficacy with limited toxicity, and widespread experience with its use. However, other NSAIDs have different safety profiles and may be preferred in some patients [1 Level I; 2 Level I].

Table 2: Major adverse effects of NSAIDs [1 Level I]

System	Adverse effects
Renal	Impaired kidney function, acute kidney failure
Cardiovascular	Increased blood pressure, fluid retention, worsening of heart failure, thrombosis, myocardial infarction, stroke, cardiovascular death
Gastrointestinal	Oesophageal, gastric, duodenal and small bowel ulceration, upper abdominal pain, gastric erosions, gastrointestinal bleeding
Respiratory	Bronchospasm in patients with NSAID-exacerbated respiratory disease*
Haematological	Impaired platelet function*
NSAID = nonsteroidal anti-inflammatory drug *** This adverse effect occurs with nonselective NSAIDs, but not COX-2-selective NSAIDs.**	

Note: The risk of harm from NSAIDs increases with increasing age, higher doses, longer durations of treatment, and concomitant use of some drugs.

Box 1: Patients who should not be prescribed an NSAID by a dentist [1 Level I]

- Patients with severe kidney impairment (eGFR of less than 30ml/min)
- Patients with severe heart failure
- Patients with an active gastrointestinal ulcer or gastrointestinal bleeding
- Patients with bleeding disorders
- Patients taking corticosteroids or anticoagulants
- Patients with multiple risk factors for increased NSAID toxicity (e.g., elderly patients with a history of gastrointestinal bleeding)

eGFR = estimated glomerular filtration rate; NSAID = nonsteroidal anti-inflammatory drug

Note: Do not use NSAIDs in pregnant women.

Table 3: Contraindications of ibuprofen and COX-2-selective NSAID [1 Level I]

Ibuprofen is contraindicated for use in patients with:	COX-2-selective NSAID (e.g., celecoxib) is contraindicated for use in patients who have history of:
• **Known hypersensitivity or idiosyncratic reaction to ibuprofen (or any of the other ingredients in the product)** • **Known hypersensitivity to aspirin and other NSAIDs** • **Asthma that is aspirin or NSAID sensitive** • **Active gastrointestinal bleeding or peptic ulceration** • **Third trimester of pregnancy**	• Stroke: cerebrovascular accident (CVA) • Heart attack: myocardial infarction (MI) • Coronary artery bypass graft (CABG) • Uncontrolled hypertension • Congestive heart failure (CHF)

2) Paracetamol

Paracetamol (or Acetaminophen) can be combined with an NSAID, or used alone in patients who cannot take NSAIDs [3 Level I].

Box 2: Patient who should receive special attention when prescribing paracetamol [1 Level I]

Significant liver disease, underweight adult, cachectic or frail patient – severe hepatotoxicity

3) Opioids

Opioids can be used for acute postoperative dental pain in adults, when nonopioid analgesics have failed to provide adequate pain relief or are unlikely to do so (e.g., severe pain). The use of codeine in children younger than 12 years of age and breastfeeding mother should be avoided. Use of codeine in children aged 12-18 years should be contraindicated post adenotonsillectomy for obstructive sleep apnoea [4 Level I; 5 Level I].

Table 4: Adverse effects with short-term use of opioids [1 Level I]

System	Adverse effects
Respiratory	• Opioid-induced ventilatory impairment (excessive sedation with or without a decrease in respiratory rate*, which is more marked during sleep • Accidental death • Increased risk of sleep-disordered breathing (central or obstructive apnoea) • Cough suppression
Neurological	Delirium, sedation, dysphoria or euphoria, miosis, impaired cognition Other adverse effects can occur in patients with renal impairment
Cardiovascular	Bradycardia, vasodilation and hypotension (including postural hypotension) – usually only seen after the use of large intravenous doses during anaesthesia or if the patient is hypovolaemic
Dermatological	Pruritus**

	Widespread urticaria – suggests an allergic response
Gastrointestinal	Nausea, vomiting, constipation, spasm of the sphincter of Oddi
Urinary	Urinary retention and difficulty with micturition, increased external sphincter tone, decreased detrusor muscle tone
*** A decrease in respiratory rate is an unreliable indicator of opioid-induced ventilatory impairment, which can coexist with a normal respiratory rate. Sedation is a more sensitive indicator of opioid-induced ventilatory impairment. ** Opioid-induced pruritus is not associated with a rash and is thought to be due to an action on opioid receptors.**	

Note: advice patients and their carers of the sedating effects of opioids.

Box 3: Patient who should receive special attention when prescribing opioids [1 Level I]

Opioids should not be offered to patients taking:

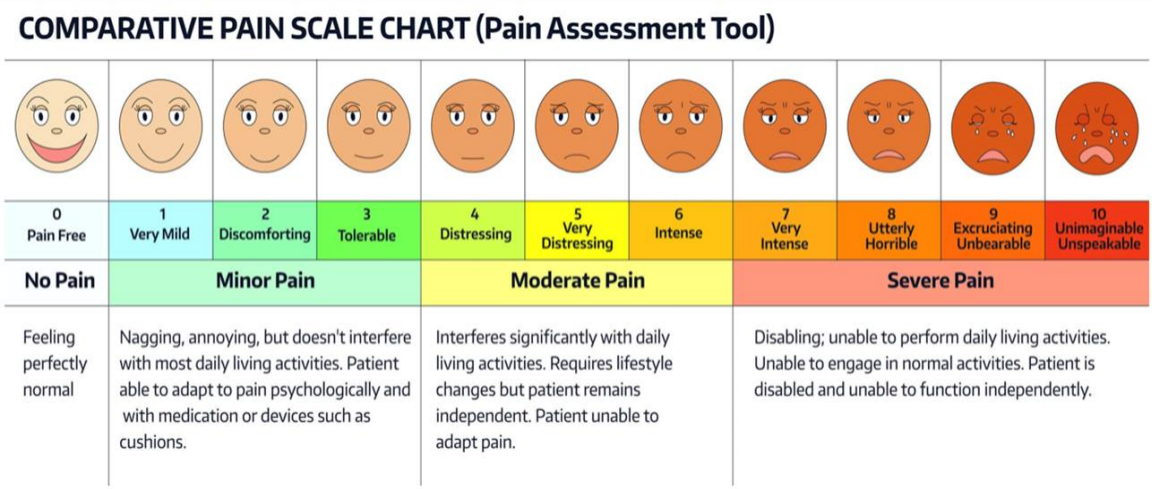
- Benzodiazepines, antidepressants, anticonvulsants, and narcotics; or
- Other central nervous system depressant medicines, including alcohol; or
- Patients already taking opioids for other medical reasons.

KEY MESSAGE: Despite significant clinical experiences with its use, codeine is no longer recommended for pain management because its use is associated with more harm than benefit [4 Level I; 5 Level I].

B. Assessment of pain severity

Clinicians were advised to assess children's pain using proper pain assessment tool (e.g., Pain scale chart as shown in Figure 1). It is a conventional pain classification based on the intensity of perceived patient pain. Although the fact that the sensation of pain is subjective, making it the most difficult feature to assess, a common point of the intensity of pain is its tolerance. Therefore, in order to evaluate the pain intensity, visual, categorical or analogue scales are used to compare pain with the worst pain than the patient ever suffered [6 Level III].

Figure 1: Comparative pain scale chart used to assess pain by an increasing factor. Scales consisting of a horizontal line, more or less 10 cm in length, one hand of which is "0", meaning literally no pain and at the opposite end "10", meaning the strongest pain endured in life.



II. Analgesic regimen for mild pain for adults following simple or surgical tooth extraction

For factors that affect the choice of analgesic regimen, (see Table 1).

Nonopioid analgesics (NSAIDs and paracetamol) should be taken regularly, rather than as required, to achieve continuous pain relief [1 Level I].

Ibuprofen 400mg orally, 6- to 8- hourly for the shortest duration possible and no more than 5 days without review

- If a COX-2 selective NSAIDs is preferred based on the patient's risk factors (see table 3), use:

Celecoxib 100mg orally, twice daily for the shortest duration possible and no more than 5 days without review

- If NSAIDs are contraindicated (see Box 1), use:

Paracetamol 500mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours) for the shortest duration possible

KEY MESSAGES:

- Must inform the patient of the usual course of pain (e.g., pain is worst 48 to 72 hours after surgery, then improves).
- Advice the patient to return to the dentist for review if pain persists.

RECOMMENDATIONS	GRADE
1. For the management of acute postoperative pain in adults undergoing 1 or more simple or surgical tooth extractions, the postoperative use of nonopioid analgesics is recommended as first-line therapy instead of opioid analgesics.	C
2. For a simple tooth extraction, postoperative pain management should be initiated by using an NSAID alone (e.g., 400mg of ibuprofen or 100mg of celecoxib) or Paracetamol alone when NSAIDs are contraindicated (e.g., 500mg)	C

III. Analgesic regimen for moderate pain for adults following simple or surgical tooth extraction

For factors that affect the choice of analgesic regimen, (see table 1).

Nonopioid analgesics (NSAIDs and paracetamol) should be taken regularly, rather than as required, to achieve continuous pain relief [1 Level I].

Ibuprofen 400mg orally, 6- to 8- hourly
for the shortest duration possible and no more than 5 days without review

PLUS

Paracetamol 500mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours)
for the shortest duration possible

- If a COX-2 selective NSAIDs is preferred based on the patient's risk factors (see table 3), use:

Celecoxib 100mg orally, twice daily for the shortest duration possible and no more than 5 days without review PLUS Paracetamol 500mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours) for the shortest duration possible

Note:

- Avoid fixed-dose combination products because they do not allow the daily dose of each drug to be maximised.
- As the tissue heals, stop ibuprofen or celecoxib and use paracetamol as a single drug.
- If NSAIDs are contraindicated (see Box 1), use:

Paracetamol 1000mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours) for the shortest duration possible

KEY MESSAGES:

- Must inform the patient of the usual course of pain (e.g., pain is worst 48 to 72 hours after surgery, then improves).
- Advice the patient to return to the dentist for review if pain persists.

RECOMMENDATIONS	GRADE
1. Following 1 or more simple or surgical tooth extractions, postoperative pain management should be initiated by using a nonsteroidal anti-inflammatory drug (NSAID) alone (e.g., 400mg of ibuprofen or 100mg of celecoxib or in combination with paracetamol (e.g., 500mg)	C

2. When NSAIDs are contraindicated, the postoperative use of paracetamol alone is recommended at full therapeutic dose (e.g., 1000mg) for the shortest duration possible	C

IV. Analgesic regimen for severe pain for adults following simple or surgical tooth extraction

- For severe acute postoperative dental pain after simple or surgical tooth extractions in patients who can use NSAIDs (see Table 2 & 3) and opioid (see Table 4 & Box 3), as a three-drug regimen, consider:

Ibuprofen 400mg orally, 6- to 8- hourly
for the shortest duration possible and no more than 5 days without review

OR

Celecoxib 100mg orally, twice daily
for the shortest duration possible and no more than 5 days without review

PLUS

Paracetamol 500mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours)
for the shortest duration possible

PLUS

Oxycodone immediate-release 5mg* orally, 4- to 6- hourly as necessary,
(Maximum dose: 288mg in 24 hours)
for the shortest duration possible and no more than 3 days (see reference note).

OR

Tramadol 50-100mg*, 4- to 6- hourly as necessary, (maximum dose: 400mg in 24 hours)
for the shortest duration possible and no more than 3 days (see reference note).

OR

Codeine 30mg*, 4- to 6- hourly as necessary, (maximum dose: 240mg in 24 hours) for the shortest duration possible and no more than 3 days (see reference note).

* Use a lower dose in elderly or frail patients because they are particularly vulnerable to adverse effects. Prescribe small quantities to avoid inappropriate use in the community.

In patients who cannot use NSAIDs (see Box 1), use paracetamol at full therapeutic dose plus opioid (see Table 4 & Box 3):

Paracetamol 1000mg orally, 4- to 6- hourly (to a maximum of 4g in 24 hours) for the shortest duration possible

PLUS

Oxycodone immediate-release 5mg* orally, 4- to 6- hourly as necessary, (Maximum dose: 288mg in 24 hours) for the shortest duration possible and no more than 3 days (see reference note).

OR

Tramadol 50-100mg*, 4- to 6- hourly as necessary, (maximum dose: 400mg in 24 hours) for the shortest duration possible and no more than 3 days (see reference note).

OR

Codeine 30mg*, 4- to 6- hourly as necessary, (maximum dose: 240mg in 24 hours) for the shortest duration possible and no more than 3 days (see reference note).

* Use a lower dose in elderly or frail patients because they are particularly vulnerable to adverse effects. Prescribe small quantities to avoid inappropriate use in the community.

Always consider the benefits, harms and regulatory requirements of prescribing an opioid (see Table 4 and Box 3). Prescribe the lowest effective dose, and advise patients to take a dose only when necessary. Ensure the patient understands the intended duration of opioid use and when to stop taking the opioid or return for review (e.g., if pain persists for longer than expected). This is of particular importance because long-term opioid use often starts with the use of opioids to treat acute pain. As the tissue heals and the patient requires less analgesia, use a stepwise approach to tapering and stopping analgesics. First, stop oxycodone

or tramadol, then stop ibuprofen or celecoxib, and lastly, stop paracetamol [1 Level I; 2 Level I; 3 Level III].

Note:

- Ensure patients understand the intended duration of opioid use.
- For patients currently taking opioids for another indication, consult their medical practitioner to determine an appropriate analgesic regimen; specialist pain management advice may be required if the patient is opioid-dependent [7 Level III].
- If opioids have not been required in hospital or pain can be successfully managed with nonopioid analgesia, do not prescribe opioids on discharge. Do not use modified-release opioids for acute dental pain [1 Level I].
- If postoperative pain persists for longer than expected, advise patients to return to the dentist for review.

RECOMMENDATIONS	GRADE
1. In the rare instances when postoperative pain control using NSAIDs alone is inadequate, it is suggested to add the previous first-line therapy prescription (i.e., NSAID and paracetamol) with an opioid (e.g., 5mg of oxycodone or 50-100mg of tramadol). The opioid prescription should consider the lowest effective dose, fewest tablets, and the shortest duration, which rarely exceeds 3 days.	C
2. When NSAIDs are contraindicated, it is suggested to use paracetamol alone at full therapeutic dose (e.g., 1000mg) with an opioid (e.g., 5mg of oxycodone or 50-100mg of tramadol) at the lowest effective dose, fewest tablets, and the shortest duration, which rarely exceeds 3 days.	C
3. For the management of acute postoperative pain in adolescents, adults, and older adults undergoing 1 or more simple or surgical tooth extractions, it is suggested against adding oral, submucosal, or intramuscular corticosteroids* to standard analgesic therapy.	C
4. For the management of acute postoperative pain in adults undergoing 1 or more simple or surgical tooth extractions, it is suggested to use the nonopioid analgesics only and recommended against the use of opioid analgesics.	C

* The role that corticosteroids may play in managing inflammatory complications (e.g., trismus, facial swelling, or infection) is not in the scope of this guideline. Intravenous administration of corticosteroids is also beyond the scope of this guideline.

V. Analgesic regimen for mild pain in children following simple or surgical tooth extraction

For factors that affect the choice of analgesic regimen, (see Table 1). Do not use aspirin in people younger than 16 years because of the risk of Reye syndrome [8 Level II]. Do not use opioids for acute dental pain in children outside the specialist setting.

For mild pain after simple or surgical tooth extraction in children (younger than 12 years), use either ibuprofen or paracetamol.

Particular care is required for dose selection in children at extremes of weight or height:

- For **children who are not obese**, calculate the dose of analgesic using the child's actual body weight, even if they are significantly underweight. If the child's weight cannot be determined, use the age-based dose in (Table 5 & 6); however, age-based dosing is imprecise for children at extremes of weight or height.
- For **children who are obese**, calculate the dose using ideal body weight; because of changes in drug pharmacokinetics in obesity, using the child's actual body weight will result in an excessive dose. If the child's height in known, estimate their ideal body weight using the corresponding weight for the height percentile on the growth chart [9 Level II]. If the child's height cannot be determined, use the age-based dose in (Table 5 & 6); however, age-based dosing is imprecise for children at extremes of weight or height.

Give doses regularly, rather than as required, to achieve continuous pain relief. Use:

1. Ibuprofen 5 to 10mg/kg* up to 400mg orally, 3 times daily, at 6- to 8-hour intervals, for the shortest duration possible and no more than 3 days without review

OR

2. Paracetamol 10 to 15mg/kg* up to 1000mg orally, 4 times daily, at 4- to 6-hour intervals,
for the shortest duration possible

* Should use the lowest effective dose and See Table 5 and 6 for the calculated doses

RECOMMENDATIONS	GRADE
1. For the management of acute postoperative dental pain in children undergoing 1 or more simple or surgical tooth extractions*, it is suggested to initiate the pain management scheme using either ibuprofen (suspension, tablet) or paracetamol (suspension, tablet, oral disintegrating tablet, caplet, rectal suppository).	C
2. When nonsteroidal anti-inflammatory drugs (NSAIDs) are contraindicated, it is suggested to use paracetamol alone.	C

* Not all extractions in children will require the use of an analgesic. This recommendation applies only when there is unresolved postoperative pain or when conducting multiple extractions.

VI. Analgesic regimen for mild and moderate pain in children following simple or surgical tooth extraction

For moderate pain after simple or surgical tooth extraction in children (younger than 12 years), use ibuprofen and paracetamol; Ibuprofen and paracetamol can be combined for enhanced pain management. Give doses regularly, rather than as required, to achieve continuous pain relief. Use:

1. Ibuprofen 5 to 10mg/kg* up to 400mg orally, 3 times daily, at 6- to 8-hour intervals, for the shortest duration possible and no more than 3 days without review

PLUS

2. Paracetamol 10 to 15mg/kg* up to 1000mg orally, 4 times daily, at 4- to 6-hour intervals,
for the shortest duration possible

* Should use the lowest effective dose and See Table 5 and 6 for the calculated doses

RECOMMENDATIONS	GRADE
1. For the management of acute postoperative dental pain in children undergoing 1 or more simple or surgical tooth extractions*, it is suggested to initiate the pain management scheme using ibuprofen (suspension, tablet) alone, or in combination with paracetamol (suspension, tablet, oral disintegrating tablet, caplet, rectal suppository) over the use of paracetamol alone.	C
2. If postoperative (that is, simple or surgical tooth extraction*) pain control using nonsteroidal anti-inflammatory drugs alone is inadequate, it is suggested to add paracetamol.	C
3. When nonsteroidal anti-inflammatory drugs are contraindicated, it is suggested to use paracetamol alone.	C
4. For the management of acute postoperative dental pain in children undergoing 1 or more surgical tooth extractions*, no recommendations can be made on the use of corticosteroids owing to a lack of evidence.	C

*Not all extractions in children will require the use of an analgesic. This recommendation applies only when there is unresolved postoperative pain or when conducting multiple extractions.

KEY MESSAGES:

- The guideline panel advises clinicians to assess children's pain using suitable tools for their ages (see Figure 1).
- The guideline panel advises clinicians to counsel patients and their caregivers that they should expect some pain and the analgesics should make their pain manageable. The guideline panel also recommends discussing with the patient, parent, guardian, or caregiver their past experiences, preferences, and values regarding managing acute dental pain before prescribing.
- The guideline panel recommends clinicians thoroughly review the patient's medical and social histories and medications and supplements to avoid overdose and adverse drug-drug interactions.
- According to the FDA, codeine and tramadol are contraindicated in children younger than 12 years [10 Level II; 11 Level II].

Table 5: Weight-based dose and approximate volumes of IBUPROFEN liquid for children

Age (years)	Average body weight (kg) *	Dose of Ibuprofen	Approximate volume of 100mg/5ml liquid **	Approximate volume of 200mg/5ml liquid **
1	9	45 to 90 mg	2.5 to 4.5 ml	1.5 to 2 ml
2	12	60 to 120 mg	3 to 6 ml	1.5 to 3 ml
3	14	70 to 140 mg	3.5 to 7 ml	2 to 3.5 ml
4	16	80 to 160 mg	4 to 8 ml	2 to 4 ml
5	18	90 to 180 mg	4.5 to 9 ml	2.5 to 4.5 ml
6	21	105 to 210 mg	5.5 to 10.5 ml	3 to 5 ml
7	23	115 to 230 mg	6 to 11.5 ml	3 to 5.5 ml
8	25	125 to 250 mg	6.5 to 12.5 ml	3.5 to 6 ml
9	29	145 to 290 mg	7.5 to 14.5 ml	4 to 7 ml
10	33	165 to 330 mg	8.5 to 16.5 ml	4.5 to 8 ml
11	36.5	182 to 365 mg	9.5 to 18 ml	5 to 9 ml
12	41	205 to 400 mg	10.5 to 20.5 ml	5.5 to 10 ml
: The average body weight-for-age values were derived from the World Health Organization (WHO) growth charts for children 5 years or younger [12 Level II] and the Centers for Disease Control and Prevention (CDC) growth charts for children older than 5 years [9 Level II].** *: For practicality, volumes have been specified to the nearest 0.5ml that achieves a dose no less than 5mg/kg or more than 10mg/kg.**				

Usual oral dosage:

Infants and children up to and including 11 years of age, <50kg: 5-10 mg/kg/dose every 6-8 hours as needed

(maximum single dose 400mg; maximum dose 40 mg/kg/24 hours)

Table 6: Weight-based dose and approximate volumes of PARACETAMOL liquid for children

Age (years)	Average body weight (kg) *	Dose of Paracetamol	Approximate volume of 100mg/5ml liquid **	Approximate volume of 200mg/5ml liquid **
1	9	135 mg	5.5 ml	3 ml
2	12	180 mg	7.5 ml	4 ml
3	14	210 mg	9 ml	4.5 ml
4	16	240 mg	10 ml	5 ml
5	18	270 mg	11.5 ml	5.5 ml
6	21	315 mg	13 ml	6.5 ml
7	23	345 mg	14.5 ml	7 ml
8	25	375 mg	15.5 ml	8 ml
9	29	435 mg	18 ml	9 ml
10	33	495 mg	20.5 ml	10.5 ml
11	36.5	547.5 mg	23 ml	11.5 ml
12	41	615 mg	25.5 ml	13 ml

***: The average body weight-for-age values were derived from the World Health Organization (WHO) growth charts for children 5 years or younger [12 Level II] and the Centers for Disease Control and Prevention (CDC) growth charts for children older than 5 years [9 Level II].**

****: For practicality, volumes have been specified to the nearest 0.5ml.**

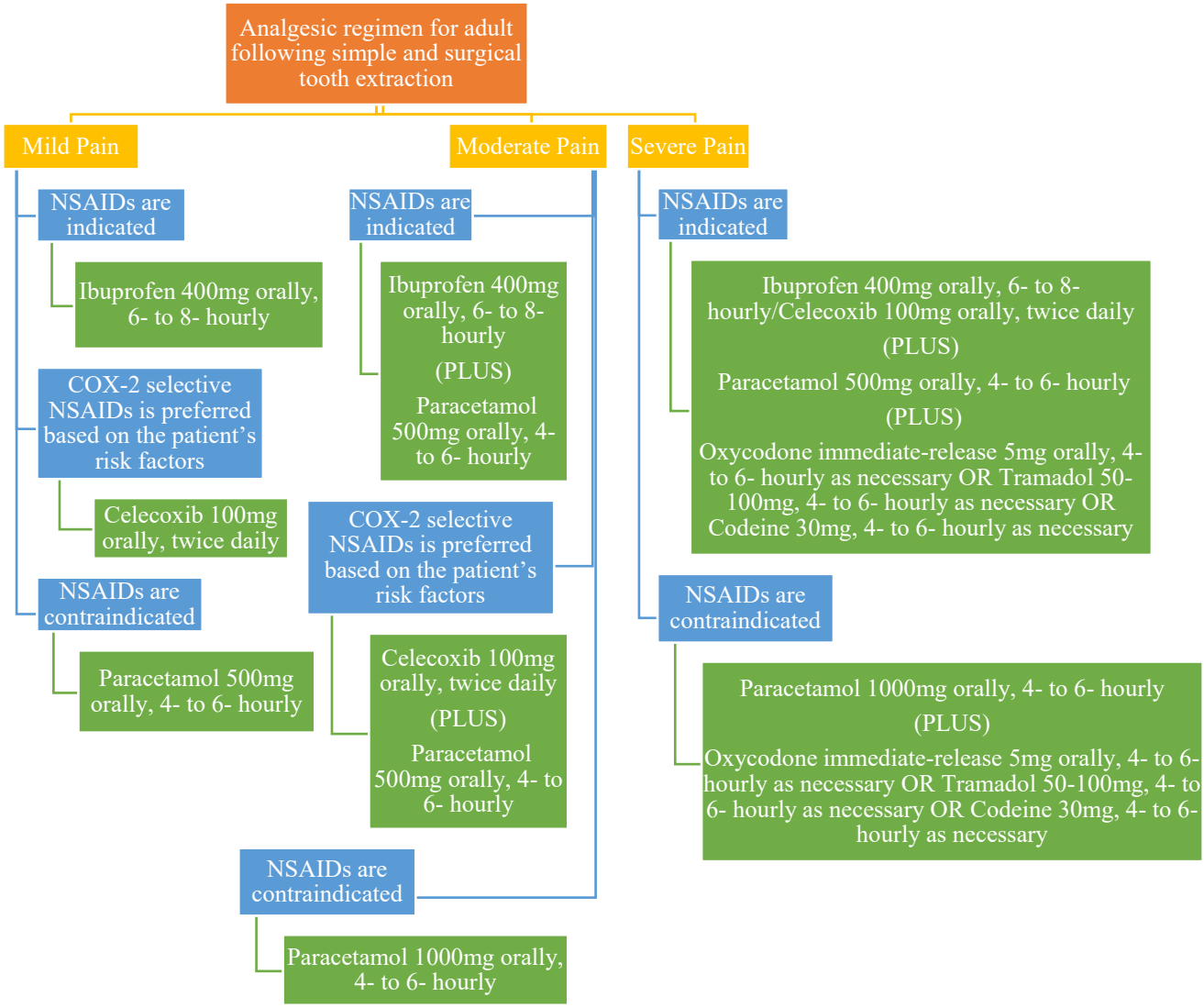
Usual oral dosage:

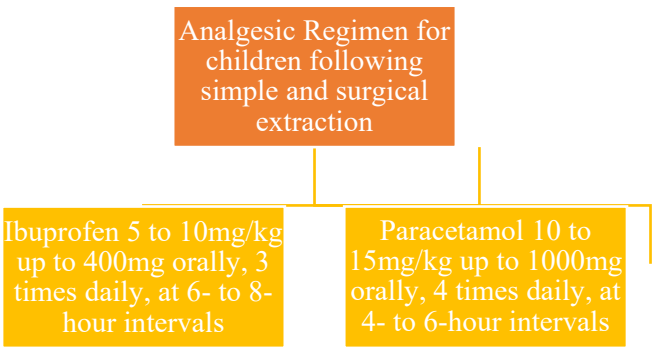
Infants and children up to and including 11 years: 10-15 mg/kg/dose every 4-6 hours as needed

(maximum 75 mg/kg/24 hours, but not to exceed 4000 mg/24 hours).

Both short- and long-term doses of paracetamol are associated with hepatoxicity.

VII. ALGORITHMS





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(www.who.int/childgrowth/standards/weight_for_age/en/)

THE MANAGEMENT OF UNERUPTED AND IMPACTED TEETH EXTRACTION

RITH Boriroth, PING Bushara

I. INTRODUCTION

Impacted and unerupted teeth are a common dental condition requiring proper diagnosis, evaluation, and treatment planning to prevent complications such as pain, infection, cyst formation, and damage to adjacent teeth. In Cambodia, where access to specialized dental care may be limited in some areas, establishing clear clinical guidelines for the management of these cases is essential to ensure safe and effective treatment. Third molars, commonly known as wisdom teeth, they usually erupt between the ages of 18 and 24. Sometimes, a wisdom tooth either fails to erupt properly tend to have some complication associated with pericoronitis, periodontitis, cystic lesions, neoplasm, pathologic root resorption, weakens the angle of mandible and makes it susceptible to fracture. Moreover, it is implicated in the etiology of lower arch crowding, temporomandibular joint (TMJ) disorders [(1), Level II, (2),Level II-1,(3),Level II, (4),Level I].

The impaction rate of third molars is significantly higher compared to other teeth. Report that third molar impaction affects up to 73% of young adults in Europe [(5)Level III].

The surgical extraction of third molars carries a risk of injury to the inferior alveolar nerve (IAN). Over the past 20 years, a new surgical method called coronectomy has been developed to minimize this risk. However, the use of this technique has sparked considerable debate among dental professionals. Given the advancements in managing unerupted or impacted third molars, the management strategies have been updated to address these concerns. Therefore, it is crucial for clinicians to use evidence-based decision-making to evaluate the latest factors involved in the treatment of this specific dental condition.

II. CASE DEFINITION

Impacted tooth refers to a tooth that has failed to fully erupt into its expected position in the dental arch within the normal developmental timeframe. This condition is often due to physical barriers such as adjacent teeth, dense bone, or lack of sufficient space in the mouth. Impacted teeth may be partially or fully blocked beneath the gums or bone.

- Impacted Tooth: A tooth that has failed to erupt into the dental arch within the expected developmental window due to lack of space, obstruction, or abnormal positioning.
- Unerupted Tooth: A tooth that has not yet emerged through the gum line, but is not necessarily impacted.

III. INDICATION

Extraction of unerupted or impacted teeth is indicated when:

- There is pain or recurrent pericoronitis.
- Associated pathology is present (e.g., cysts, tumors).
- Tooth is causing or may cause resorption or damage to adjacent teeth.
- The tooth interferes with orthodontic treatment or prosthetic rehabilitation.
- Tooth is non-functional or malpositioned with no potential for proper eruption.
- There is a risk of infection or localized inflammation.

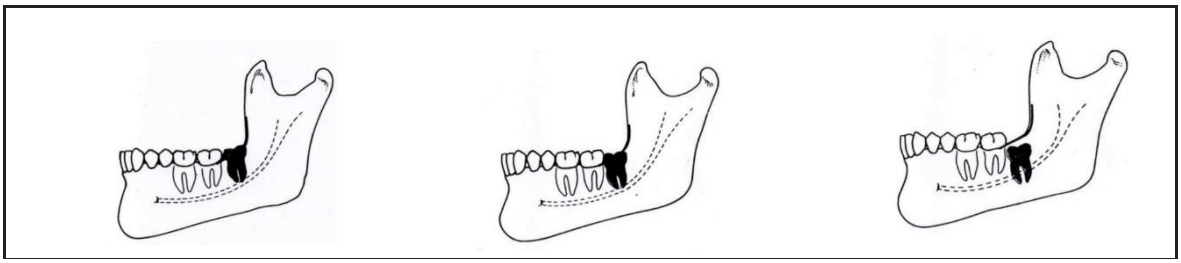
The following outlines the key indications for removing impacted third molars:

3.1. CARIES

A meta-analysis of moderate-quality cross-sectional studies revealed that the presence of third molars is linked to a higher risk of caries in adjacent molars. This association was assessed through various classification systems[(1) Level II]:

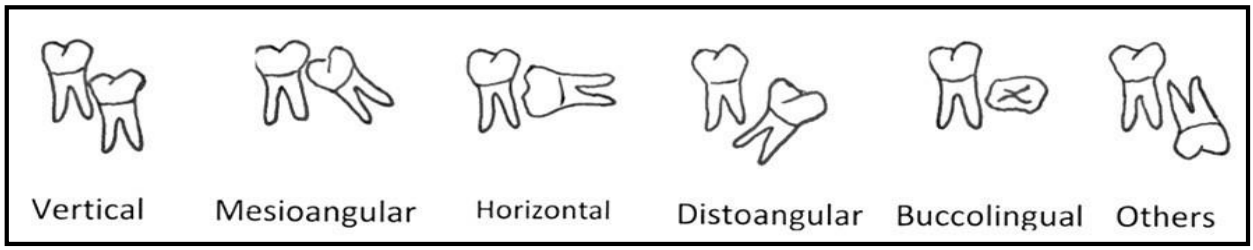
- **Pell & Gregory Classification**: Comparison of third molars in A versus C positions (see Figure 1).
- **Winter's Classification**: classified of third molars base on angulation such as vertical, mesioangular,horizontal, Distoangular, Buccolingual and others (see Figure 2).

Figure 1: PELL AND GREGORY CLASSIFICATION



Class A impaction. Occlusal plane of impacted as occlusal plane of second molar.	**Class B impaction.** Occlusal plane of impacted tooth is between occlusal plane and cervical line of secondmolar.	**Class C impaction.** Impacted tooth is belowcervical line of second molar.

Figure 2: WINTER'S CLASSIFICATION



3.2. PERIODONTAL PROBLEM

In a Cochrane systematic review(1) Level II, the presence of third molars was found to potentially contribute to increased probing depth and alveolar bone loss on the distal surface of the second molar. The same review noted that the absence of third molars, when compared to their presence, was associated with:

- A lower risk of probing depths greater than 4 mm at the distal side of the adjacent second molar in cases of soft tissue impaction, but not in cases of bony impaction.
- A decreased risk of alveolar bone loss at the distal side of the adjacent second molar in both soft tissue and bony impaction scenarios, with relative risks (RR) of 0.11 and 0.32, respectively.

3.3. PATHOLOGY/CYST OR IN THE LINE OF MANDIBULAR FRACTURE

Impacted third molars should be removed when it is associated with cyst/tumour.

The angle of the mandible is a frequent location for mandibular fractures. An impacted lower third molar can align with the fracture site, potentially leading to complications like infection if not extracted. Typically, the decision to remove an impacted third molar should be made based on clinical judgment.

3.5. ORTHOGNATHIC SURGERY

One complication that can arise during bilateral sagittal split osteotomy (BSSO) in orthognathic surgery is a "bad split," which refers to an undesirable fracture pattern. A meta-

analysis indicated that there was no significant difference in the occurrence of bad splits between patients who had their lower third molars removed at the same time as the surgery and those who had them extracted at least six months before[6],Level I. Nevertheless, in clinical practice, lower third molars are typically removed prior to the surgery.

3.6. ASYMPTOMATIC THIRD MOLAR

Prophylactic removal of asymptomatic third molars refers to the extraction of these teeth when no local disease is present. According to a Cochrane systematic review[4], Level I, there is insufficient evidence to support the removal of asymptomatic impacted third molars. However, it is important to consider potential risks to the adjacent second molar or other possible complications related to retaining the third molar, particularly in light of the patient's medical or surgical conditions. Clinicians must weigh the risks and benefits while involving the patient in the decision-making process.

IV. DIAGNOSIS

HISTORY TAKING

- **Medical History Evaluation**: Assess the patient's medical history thoroughly, paying special attention to allergies, current medications, and any systemic conditions such as bleeding disorders or cardiovascular issues. Also, review the dental history for any previous extractions or complications.
- **Informed Consent**: Provide a detailed explanation of the procedure, including its risks, benefits, and post-operative care. Ensure that the patient understands all aspects and discuss alternatives to the procedure. Finally, obtain written consent form the patient. (See subtitle VIII)

CLINICAL EXAMINATION

The diagnosis of unerupted and/or impacted third molars is made through comprehensive history taking and a thorough clinical examination. Common signs and symptoms associated with this condition include:

- Pain
- Swelling
- Trismus (restricted mouth opening)

- Fever

Imaging may be necessary to confirm the diagnosis and assess the tooth's morphology, surrounding structures, and any associated pathological conditions, such as caries, periodontal disease, or cysts.

INVESTIGATION

Imaging techniques such as periapical, panoramic, or cone-beam computed tomography (CBCT) are utilized to assess the position of the impacted tooth, root anatomy, and proximity to adjacent structures.

- **Periapical X-rays**: For detailed assessment of root and adjacent structures.
- **CBCT (Cone Beam CT)**: Recommended when nerve involvement is suspected or for complex surgical planning (may be limited in rural Cambodian settings). To evaluate tooth anatomy, root structure, and surrounding bone, it is essential to obtain appropriate radiographs.
- **Panoramic radiograph (OPG)**: First-line imaging for assessment of position, angulation, and pathology. The most commonly used plain radiographs for managing unerupted and/or impacted third molars are the orthopantomogram (OPG) and intraoral periapical (IOPA) radiographs[(7),Level II-2, (8), Level II-2]. Three meta-analyses investigated predictors of inferior alveolar nerve (IAN) exposure in OPGs among patients with impacted mandibular third molars, with the number of primary studies ranging from five to nine and classified as moderate quality. The sensitivities and specificities of these predictors are summarized in the accompanying table.
- Among the predictors, the darkening of the root and interruption of the radiopaque border of the mandibular canal were found to be more reliable indicators of IAN injury compared to others. However, the studies concluded that more high-quality evidence is needed before OPG can be recommended for IAN assessment.
- CBCT represents a significant advancement in dental imaging, offering a three-dimensional view of the relationships between orofacial structures. It is widely used for diagnosis and treatment planning of unerupted and/or impacted third molars. A systematic review comparing the diagnostic accuracy of CBCT and OPG in predicting IAN exposure in impacted third molars found conflicting results from two

diagnostic studies[9], Level I. Due to the limited evidence in the systematic review, a definitive conclusion cannot be drawn.

V. MANAGEMENT

PREOPERATIVE PREPARATION

- Informed consent.
- Antibiotic prophylaxis (for patients with high infection risk or comorbidities).
- Ensure sterile environment and aseptic technique.

SURGICAL PROCEDURE

The surgical procedure for the removal of an impacted third molar typically includes the following steps:

- **Raising Soft Tissue Flaps**: Soft tissue flaps (triangular or envelope) are elevated to gain access to the impacted tooth, potentially with the retraction of a lingual flap.
- **Bone Removal**: Bone is removed using a chisel or bur, accompanied by irrigation to maintain a clear field and prevent overheating.
- **Tooth Extraction**: The entire tooth is then delivered, which may involve division into segments if necessary.
- **Wound Care**: A thorough wound toilet is performed, followed by suturing to close the surgical site.

A Cochrane systematic review, which included low to moderate quality primary studies, assessed the relative benefits and risks associated with different techniques for the surgical removal of mandibular wisdom teeth[10], Level I. The review reached the following conclusions:

- **Flap Design**: Triangular flaps were found to be associated with reduced pain at 24 hours and a 71% decrease in the incidence of alveolar osteitis after one week compared to envelope flaps. There were no significant differences in overall infection rates, maximum mouth opening, or permanent loss of sensation. However, a slight increase in residual swelling was noted after one week with triangular flaps.

- **Lingual Flap Retraction**: This technique resulted in more instances of temporary altered sensation lasting up to one month.
- **Bone Removal Techniques**: Due to the limited number of studies and variability in outcomes, no conclusions could be drawn regarding the use of bur versus chisel for bone removal.

Overall, there is insufficient evidence regarding the use of lingual flap retraction and the methods of bone removal in impacted third molar surgery. Nevertheless, in local practice, lingual flap retraction is generally avoided due to the risk of injuring the lingual nerve, while the bur is the preferred tool for bone removal.

CORONECTOMY

Coronectomy is an alternative approach to surgically extracting impacted mandibular third molars that pose a significant risk of injury to the inferior alveolar nerve (IAN). The primary goal of the coronectomy technique is to minimize the risk of IAN injury by removing the crown of the wisdom tooth while leaving the roots that are close to the nerve intact[11], Level I.

The key criteria for performing a coronectomy include:

- A high risk of IAN injury
- A vital mandibular third molar
- A healthy, non-immunocompromised patient
- Patient access to care and an understanding of the associated risks of coronectomy.

POSTOPERATIVE CARE

- Analgesics (e.g., paracetamol, NSAIDs).
- Antibiotics if signs of infection or risk is high.
- Oral hygiene instructions: warm saline rinses, avoid spitting and drinking through a straw.
- Follow-up visit in 5–7 days for suture removal and assessment.

VI. COMPLICATIONS

The intraoperative and post-operative complication rate for third molar surgery varies between 3.7% to 8.3% respectively[12], Level II-1. The most frequently encountered complications include:

- Intraoperative complications included: Tuberosity fractures (1.2%), root fractures (1.1%), bleeding (0.7%), soft tissue injuries (0.5%), and damage to adjacent teeth (0.2%).
- Postoperative complications consisted of: Sensory nerve injuries (7.2%), swelling/pain/trismus (0.6%), and dry socket (0.5%). Nerve injury was temporary in 41 patients and permanent in four cases. A statistically significant correlation was found between patients aged 30-39 and the occurrence of dry socket (P = 0.010), as well as between bone removal and all postoperative complications (P = 0.001)[12], Level II-1.

DRY SOCKET

A Cochrane systematic review was unable to provide sufficient evidence to recommend any treatment for dry socket[13], Level I. (**Refer to Treatment of Dry-Socket Section)**

INFECTION

Based on clinical judgment, it is recommended that antibiotics be administered to address established postoperative infections. (**Refer to Antibiotic Use in Dentistry Section)**

BLEEDING

Postoperative bleeding following the surgical removal of unerupted and/or impacted third molars may arise from either local or systemic factors. Given the limited evidence available, it is advised that postoperative bleeding be managed appropriately. **(Refer to Bleeding Control Section)**

INFERIOR ALVEOLAR NERVE INJURY

The improvement of neurosensory deficits following surgical and non-surgical treatments varies. This aspect has not been assessed in any randomized controlled trials (RCTs), so no definitive conclusions can be made at this time.

PLATELET RICH FIBRIN

Platelet-rich fibrin (PRF) is a platelet concentrate that serves as a reservoir for and releases crucial growth factors, including vascular endothelial growth factor (VEGF), transforming growth factor (TGF), and platelet-derived growth factor (PDGF). A meta-analysis of low to moderate quality randomized controlled trials (RCTs) with a moderate risk of bias indicated that the use of PRF in postoperative mandibular third molar extraction[14), Level I]:

- Reduced postoperative pain on day 3
- Decreased swelling on day 1
- Lowered the risk of alveolar osteitis
- Showed no significant improvement in trismus, osteoblastic activity, or soft tissue healing.

However, evidence regarding the effectiveness of PRF in reducing pain, swelling, and alveolar osteitis is limited. Therefore, there is no substantial clinical benefit in utilizing PRF for postoperative third molar surgeries.

FOLLOW-UP

Monitoring of unerupted and/or impacted third molars, as well as post-coronectomy cases, should be included as part of routine dental check-ups on an annual basis, considering the potential future complications that may arise from retained third molars.

CONCLUSION

The management of unerupted and impacted teeth in Cambodia requires a balance of evidence-based protocols and adaptation to local healthcare infrastructure. Proper diagnosis, risk assessment, and surgical competence are key to safe and effective outcomes. Efforts should also focus on training, patient education, and strengthening referral networks.

CONSENT FORM

គ្លីនិកធ្មេញ កកកក
KKKK DENTAL CLINIC

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កិច្ចសន្យាវះកាត់ មុខមាត់ធ្មេញ

កិច្ចសន្យាវះកាត់ មុខមាត់ធ្មេញនេះ ត្រូវបានធ្វើឡើងដោយការព្រមព្រៀងរវាង **គ្លីនិកធ្មេញ កកកក** ជាមួយអ្នកជំងឺ

ឈ្មោះ៖.....ភេទ៖.....ថ្ងៃខែឆ្នាំកំណើត/អាយុ៖.....

លេខទូរសព្ទ(1).....(2).....

E-mail៖.....

មូលហេតុនៃការវះកាត់៖.....

រោគវិនិច្ឆ័យ៖.....

Indication:.....

A. **<u>អំពីការព្យាបាលដោយការដកធ្មេញ ឬ/និង ការវះកាត់</u>**

ការយកធ្មេញចេញដោយការដក ឬ/និង ការវះកាត់ អាចតម្រូវឲ្យមានការកាត់ជាបំណែកតូចៗ ឬ/និង វះបើកអញ្ចាញ ឬ/និង កាត់ឆ្អឹងចេញមួយចំនួនអាស្រ័យតាមរោគវិនិច្ឆ័យជាក់ស្តែង។ ករណីចាំបាច់ដូចជាការពិនិត្យឈាម ឬ ថតស្ពេនជាដើមដែលត្រូវភ្ជាប់ជាមួយការពិនិត្យបែបវេជ្ជសាស្ត្រ ឬ/និង អមវេជ្ជ សាស្ត្រ គ្លីនិកយើងខ្ញុំអាចនឹងស្នើអ្នកជំងឺទៅទទួលសេវាកម្មនៅគ្លីនិកដែលជាដៃគូ។

B. **<u>ផលវិបាកដែលអាចកើតឡើងក្រោយការព្យាបាលដោយការដក ឬ វះកាត់</u>**

1. **<u>អាចមានការហូរឈាម ហើម ពិបាកហាមាត់ និង ការបង្ករោគ</u>**៖

អាការៈទាំងនេះអាចកើតមានឡើងរយៈពេលខ្លីក្រោយការវះកាត់។ ករណីហើមនឹងត្រូវព្យាបាលដោយថ្នាំបំបាត់ការឈឺចាប់ ការបង្ករោគនឹងត្រូវព្យាបាលដោយការប្រើប្រាស់ថ្នាំផ្សះ។ ករណីកម្រខ្លះដូចជា៖ ការកកិតបបូរមាត់ អណ្តាត ក្រអូមមាត់ ជាដើម ដែលអាចកើតឡើងជាយថាហេតុក្នុងពេលព្យាបាល អាចតម្រូវឲ្យមានការព្យាបាលបន្ទាប់បន្សំជាមួយគ្នាផងដែរ។

2. **<u>អាចមានប្រតិកម្មជាមួយថ្នាំលេប ថ្នាំស្ពឹក និង/ឬ ថ្នាំសណ្តំ</u>**៖

នៅមុនពេលចូលព្យាបាលដោយការដក ឬ វះកាត់ គ្រូពេទ្យនឹងធ្វើការសាកសួរអំពីប្រវត្តិជម្ងឺរបស់អ្នកជម្ងឺ មុនពេលប្រើប្រាស់ថ្នាំក្នុងទម្រង់លេប ឬចាក់។ ប៉ុន្តែ ប្រសិនបើមានប្រតិកម្មជាមួយថ្នាំលេប ថ្នាំស្ពឹក និង/ឬ ថ្នាំសណ្តំកើតឡើងដោយមិនបានដឹងជាមុន គ្លីនិកយើងខ្ញុំនឹងផ្តល់ថ្នាំបន្សាបប្រតិកម្មតាមបច្ចេកទេសវេជ្ជសាស្ត្រ។

3. **<u>អាចមានការឈឺរួយសន្លាក់ឆ្អឹងថ្គាម(TMJ)</u>**៖

នៅក្នុងពេលព្យាបាលដោយការដកធ្មេញ ឬវះកាត់ធ្មេញ អ្នកជម្ងឺអាចនឹងត្រូវហាមាត់យូរអាស្រ័យលើករណីធ្មេញនីមួយៗ។ ទោះបីមានការប្រើប្រាស់ឧបករណ៍ទប់លំនឹងថ្គាមក្នុងពេលព្យាបាលក៏ដោយ ករណីខ្លះក៏នៅមានការបង្ករោគ ការរួយសន្លាក់ឆ្អឹងថ្គាមក្រោយការព្យាបាលមួយរយៈផងដែរ។

4. **<u>អាចមានការឈឺចាប់ខ្លាំងដោយសារបញ្ហាស្ងួតរណ្តៅធ្មេញ៖</u>**

ជាទូទៅក្រោយការព្យាបាលដោយការដកធ្មេញ ឬការវះកាត់ កំណកឈាមអាចនឹងជ្រុះ ឬ មិនមានកំណកឈាមគ្រប់គ្រាន់សម្រាប់ជួសជុល ឬផ្សះមុខរបួស។ ហានិភ័យនេះអាចកើតឡើងនៅពេលដែលអ្នកជម្ងឺពិសាបារី ថ្នាំពន្យារកំណើត(ចំពោះស្ត្រី) ការពិសាសារធាតុរាវដោយប្រើបំពង់បឺត ការពិសាអាហាររឹង ការឆ្លុះកំណកឈាម ការខ្ពុលទឹកខ្លាំងៗ ជាដើម។ វាអាចបង្កឲ្យមានការឈឺចាប់ខ្លាំងនៅថ្ងៃបន្ទាប់។ ហេតុនេះ បើមានករណីនេះកើតឡើងសូមមកទទួលការដាក់ថ្នាំនៅក្នុងរណ្តៅធ្មេញនោះនិងតាមដានជាប្រចាំរហូតមានការធូរស្រាល ។

5. **<u>អាចមានផលប៉ះពាល់លើធ្មេញជិតខាង៖</u>**

ករណីខ្លះ ការដកធ្មេញអាចបណ្តាលឲ្យមានការស្រាំធ្មេញ ឬបែកបាក់សាច់ធ្មេញកំណើត ឬធ្មេញសិប្បនិម្មិតដែលនៅក្បែរនោះ ទោះបីមានការប្រុងប្រយ័ត្នអំឡុងពេលព្យាបាលក៏ដោយ។

6. **<u>អាចមានការឆ្លាយប្រហោងប្រអប់ខ្យល់នៅតំបន់ផ្ទៃមុខ៖</u>**

ករណីខ្លះ ការដក ឬវះកាត់ធ្មេញនៅតំបន់ខាងលើផ្នែកខាងក្រោយ អាចមានហានិភ័យឆ្លាយប្រអប់ខ្យល់ នៅពេលដែលរចនាសម្ព័ន្ធនោះ ស្ថិតនៅកៀកជាមួយធ្មេញដែលត្រូវព្យាបាល។

7. **<u>អាចមានការបែកឆ្អឹងកំឡុងពេលដក៖</u>**

នៅពេលដក ឬការវះកាត់ធ្មេញចេញរួច ឆ្អឹងដែលនៅក្បែរនោះអាចមានសភាពរីក ឬបែកជាបំណែកតូចៗ។ ករណីខ្លះឆ្អឹងនៅក្បែរៗនោះក៏អាចបែកមកជាមួយជាបំណែកតែម្តង ជាពិសេសនៅពេលយកធ្មេញថ្គាមទាល់ខាងលើចេញ។ ប៉ុន្តែករណីនេះ ជាករណីកម្របំផុតណាស់។

8. **<u>អាចមានការបាក់ឫសធ្មេញ៖</u>**

ករណីខ្លះ អាចមានការបាក់ចុងឫសធ្មេញនៅពេលដក ឬវះកាត់ ហើយគ្រូពេទ្យអាចទុកឫសធ្មេញនោះមិនយកចេញ ដោយថ្លឹងថ្លែងជាមួយរចនាសម្ព័ន្ធសំខាន់ៗជុំវិញឫសធ្មេញនោះ។ ជាទូទៅចុងឫសធ្មេញដែលនៅសល់នោះមិនមានការបង្ករោគឡើយ។

9. **<u>អាចមានបញ្ហាស្ពឹកក្រោយការដក ឬវះកាត់ធ្មេញ៖</u>**

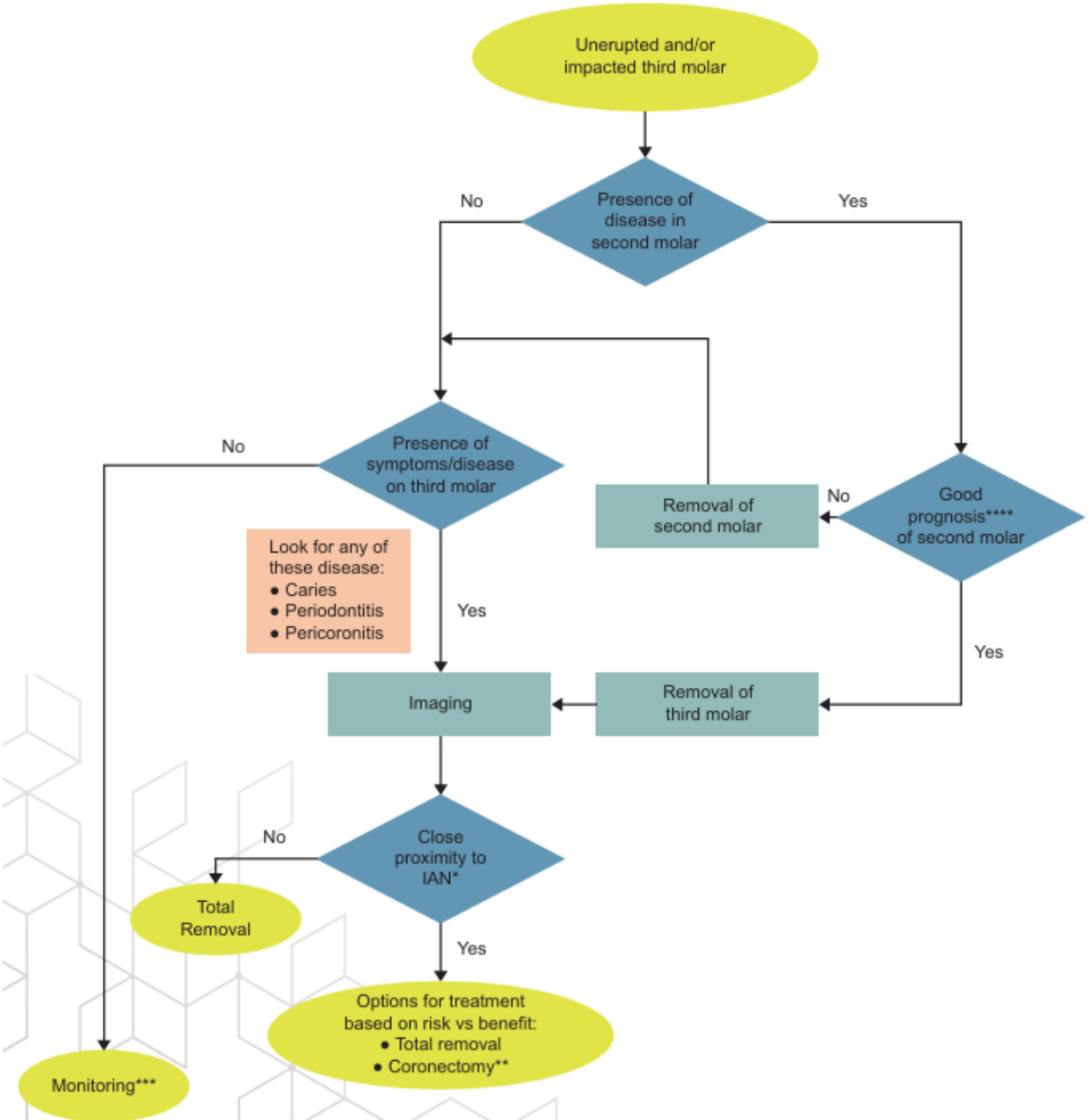
ករណីខ្លះ សរសៃប្រសាទខាងក្រោមមានការប៉ះទង្គិច ឬ មុត ឬ ដាច់ ជាយថាហេតុអំឡុងពេលដក ឬវះកាត់ធ្មេញ ដែលអាចបង្កឲ្យមានការស្ពឹកបបូរមាត់ ឬ/និងអណ្តាតរយៈពេលច្រើនសប្តាហ៍ ឬច្រើនខែ ឬមិនកំណត់។

ខ្ញុំសូមបញ្ជាក់ថា ខ្ញុំបានអាន និងបានទទួលការអានន្យវខ្លឹមសារនៃទម្រង់ខាងលើ ហើយបានដឹងពីហានិភ័យនៃការព្យាបាល និងយល់ព្រមចំពោះការព្យាបាលនេះ។

ហត្ថលេខាអ្នកជម្ងឺ

ថ្ងៃ/ខែ/ឆ្នាំ_____

ALGORITHM



*IAN : Inferior Alveolar Nerve

**Monitoring of post-coronectomy cases should be done periodically.

***Patients should be made aware of the risks that can arise even when it is asymptomatic and be involved in the decision making.

****Good prognosis refers to restorable cavity, periodontally stable, etc.

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(Level II)

ODONTOGENIC KERATOCYST (OKC)

CHHIV Eangseng

I. INTRODUCTION

Odontogenic keratocyst (OKC) was first introduced by Philipsen in 1956 [1 Level III]. World Health Organization (WHO) designated the OKC as a keratocystic odontogenic tumor (KCOT) in 2005. KCOT has been defined as a unilocular or multilocular radiolucency on imaging, intraosseous tumor of odontogenic origin, with a characteristic lining of parakeratinized stratified squamous epithelium and potential for aggressive, infiltrative behavior, often associated with the mandible and maxilla. With the high recurrence rate of KCOTs ranges from 13.1% [2 Level II] to 62.5% [3 Level II, 4, 5, 6 Level III], surgical techniques play a very important role. Recommended techniques have included tanning the cystic cavity with Carnoy's solution before enucleation [7,8 Level III] or using a combination of enucleation and liquid nitrogen cryotherapy [9 Level III], whereas others recommend techniques such as marsupialization or decompression of the cysts followed by secondary enucleation [10,11,12 Level III]. Specifically, Bramley [13 Level III] recommended the use of radical surgery with resection and bone transplantation, whereas Ephros and Lee [14 Level III] advocated the removal of the lateral cortical plate and enucleation of the cyst. Bataineh and Qudah [15 Level II] advocated resection without continuity defects as a standard treatment for preoperatively diagnosed KCOT. To reduce the high recurrence rate of KCOT, it is essential to completely eradicate the epithelial components of the cyst [16 Level III].

II. CASE DEFINITION

An odontogenic keratocyst is a benign cystic lesion originating from the odontogenic epithelium, typically found in the jaws. It features a thin, keratinized lining and is known for its tendency to recur. On imaging, OKCs may appear as unilocular or multilocular radiolucency and are often linked to impacted teeth. While they can be asymptomatic, they may lead to jaw expansion or discomfort. OKCs are recognized as a distinct entity due to their unique histological characteristics and behavior, especially regarding their recurrence after treatment.

KEY MESSAGE
Given the high recurrence rates, enucleation alone is not considered an adequate treatment for OKC, regardless of its size.

III. ETIOLOGY AND PATHOGENESIS

The exact cause of OKC remains unclear, but several factors are implicated:

- **Developmental Origin**: OKC originated from odontogenic epithelium. Remnants of dental lamina and also proliferations of the basal cell layer of oral epithelium are considered as possible sources of epithelial cells which may proliferate to form an OKC [6 Level III].
- **Genetic Factors**: Some cases are associated with genetic conditions like Nevoid Basal Cell Carcinoma Syndrome (NBCCS).
- **Environmental Influences**: Previous trauma or infection may also play a role in their development.

IV. DIAGNOSITC AND PRE-SURGICAL PROCEDURE

- **Clinical Assessment**: Typically, asymptomatic; may present with swelling or pain if infected. A thorough clinical examination must be conducted, particularly including palpation of any potential swelling. Sensitivity in all affected teeth should be assessed. Additionally, signs of paresthesia or dysesthesia in the mandibular or maxillary nerve territories should be noted, as these may arise from nerve compression due to the cyst. Penetration of cortical bone and involved surrounding soft tissues due to the aggressive behavior of OKC is documented.
- **Radiographic Features**: Characterized by well-defined, unilocular or multilocular radiolucency with scalloped borders on orthopantomogram. A three-dimensional examination can give a proper evaluation of the real volume of the lesion, determining the accurate proximity with any important anatomical structure.
- **Biopsy Evaluation and Histopathology**: Characterized by a thin, keratinized stratified squamous epithelial lining, often showing a palisaded basal cell layer, OKC typically has a greater potential for aggressive behavior and high recurrence. Therefore, biopsy is mandatory to confirm the final diagnosis before treatment decision.
- **Association with Syndromes:** Nevoid Basal Cell Carcinoma Syndrome (NBCCS), also known as Gorlin-Goltz syndrome, where patients may develop multiple OKCs along with other lesions such as basal cell carcinomas, skeletal abnormalities, and palmar/plantar pits.

KEY MESSAGE
It is crucial to remember that aggressive surgical procedures often require additional reconstructive interventions afterwards. Therefore, a balance must be struck between effectively minimizing the risk of OKC recurrence and selecting the least invasive surgical approach for each patient.

V. DIFFERENTIAL DIAGNOSIS

- Radicular (Periapical) Cyst: Associated with non-vital teeth, usually located at the apex and radiographic feature showing well-defined, unilocular radiolucency.
- Dentigerous Cyst: Associated with the crown of an unerupted tooth, typically mandibular third molars.
- Ameloblastoma: Typically occurs in the posterior mandible, though it can also affect the maxilla. Radiographically, it presents as either a multilocular or unilocular radiolucency, often manifesting as painless swelling or bony expansion.
- Aneurysmal Bone Cyst (ABC): Can occur in both the maxilla and mandible, more common in the posterior regions.
- Traumatic Bone Cyst (Simple Bone Cyst): Generally asymptomatic, but may present with swelling or a pathologic fracture. Radiographically, it presents a unilocular radiolucency with a well-defined border, typically with scalloping around the roots of adjacent teeth.

VI. MANAGEMENT

The surgical treatment of OKC is significantly more complicated than that of other jaw cystic lesions due to challenges such as the removal of thin, fragile walls, the presence of multilocular lesions, and a high tendency for recurrence after surgery.

Management strategies for OKC include:

1. Enucleation: Given the high recurrence rates, enucleation alone is not considered sufficient for treating OKC [17 Level III]. To enhance the outcomes of enucleation, peripheral ostectomy was introduced to remove residual tumor tissue or satellite microcysts from the edges of the defect, especially in multilobular and multilocular cases. While this technique can help reduce the risk of recurrence, a significant drawback is the inability to control the amount of bone removed [17 Level III].

2. Resection: Resection of the affected region has been shown to be highly effective in preventing recurrences. Along with bone resection, excising the soft tissues surrounding

lesions that have perforated the cortical bone is essential for minimizing recurrence risk, as these perforating lesions typically exhibit higher recurrence rates than non-perforating ones [18 Level III]. This strategy has resulted in the complete elimination of recurrences during follow-up periods of up to eight years [19 Level III]. Due to its associated morbidity and the benign nature of OKC, resection is not considered a first-line treatment. It should be reserved for cases with multiple recurrences.

3. Decompression: Another commonly used approach for treating large OKC is decompression to decrease the volume and the proximity with close vital anatomical, followed by enucleation in a second stage surgery. Decompression refers to any technique aimed at relieving intra-cystic pressure that contributes to cyst expansion. This is typically achieved by creating an opening in the cyst wall. In most cases, decompression methods utilize a drain to keep the cyst cavity open. Initially, the cavity is flushed with a physiological saline solution or a chlorhexidine mouthwash, and after a few weeks, the flushing is switched to drinking water. The primary goal of this procedure is to reduce the size of the original lesion, making complete removal easier during the second surgery and minimizing the risk of injury to surrounding anatomical structures, such as the inferior alveolar nerve and adjacent teeth, etc. The evolution of the lesion is monitored every three months through radiological and clinical examinations, with particular attention to the position of the drain. As intracystic pressure decreases, new bone formation along the periphery of the cystic wall can be observed in radiological follow-up exams. Decompression facilitates the gradual replacement of the lesion with bone, creating distance between the lesion and nearby anatomical structures. Additionally, when used for OKC treatment, decompression often leads to thickening of the lesion wall, further facilitating the enucleation of any remaining tumor tissue. Brondum and Jensen reported no recurrences in a series of 12 OKCs treated with decompression followed by enucleation, compared to 8 out of 44 (18%) recurrent cases of OKCs treated with one-stage enucleation [5 Level III]. In addition, Stoelinga and colleagues proposed a treatment protocol involving enucleation, followed by the application of “Carnoy’s solution” made up of ethanol (6 ml), chloroform (3 ml), glacial acetic acid (1 ml) and ferric chloride (1 g) and excision of the soft tissues in contact with the cystic lining; however, the inferior alveolar nerve and other surrounding anatomical structures needed to be protected due to the potential toxicity involved. This approach reduced the recurrence rate to 6%, compared to 18% in a group of lesions treated with enucleation alone [18 Level III].

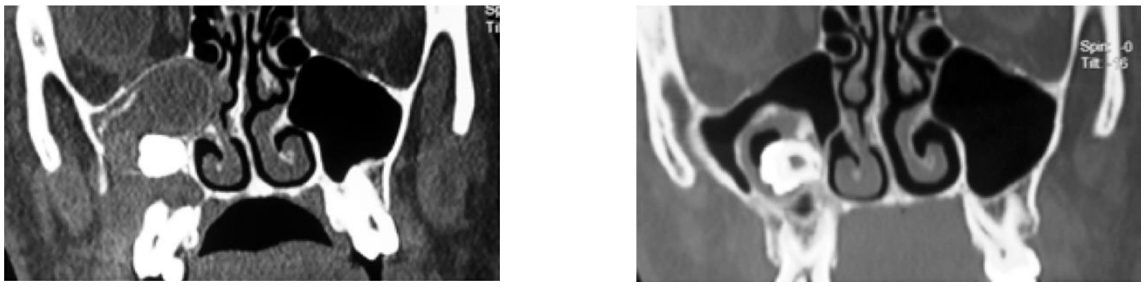

Figure 1. Coronal CT scans of KCOT of right maxilla, before and six months after the decompression. Significant reduction in size of the lesion is apparent. [19]

KEY MESSAGE
Decompression approach requires rigorous flushing and the use of plugs to seal the cannula opening, preventing food from accumulating or entering the cyst cavity, leading to infection.

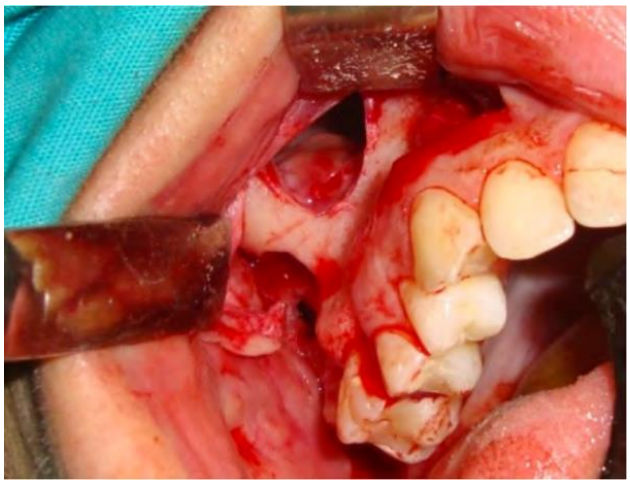

Figure 2. Clinical photograph of the lesion in figure 1. A Caldwell-Luc approach was used for enucleation at the second stage surgery [20 Level III].

Figure 3. Unilocular radiolucency of the left mandibular body involving the left interior alveolar nerve with histological analysis of biopsy specimen revealed a keratocystic odontogenic tumor.

Figure 4. Intraoral photograph of the left mandible.

KEY MESSAGE
Given the consensus that standard treatment options for cystic lesions of the jaws are insufficient for OKC management, it is important to make extra efforts to ensure accurate diagnosis in uncertain cases. A biopsy is mandatory to confirm the diagnosis of OKC and assess treatment success.

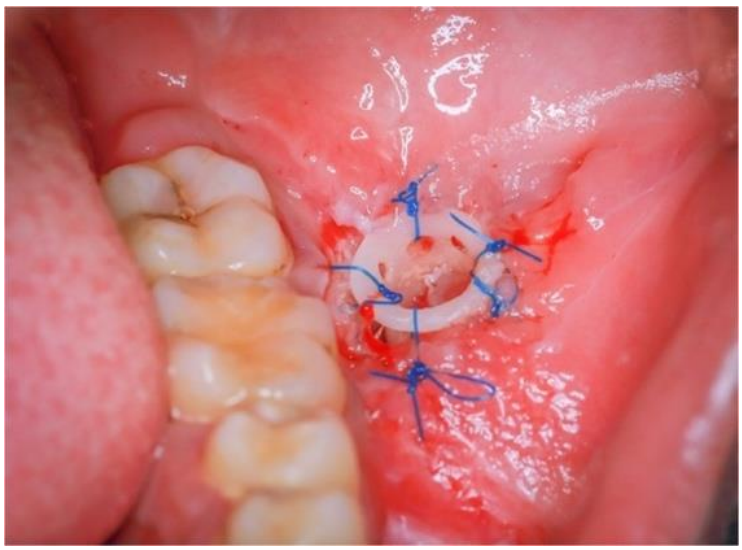

Figure 5. Intraoral photograph of the left mandible showing reinforcing sutures used to stabilize the
prefabricated individual resin cannula.

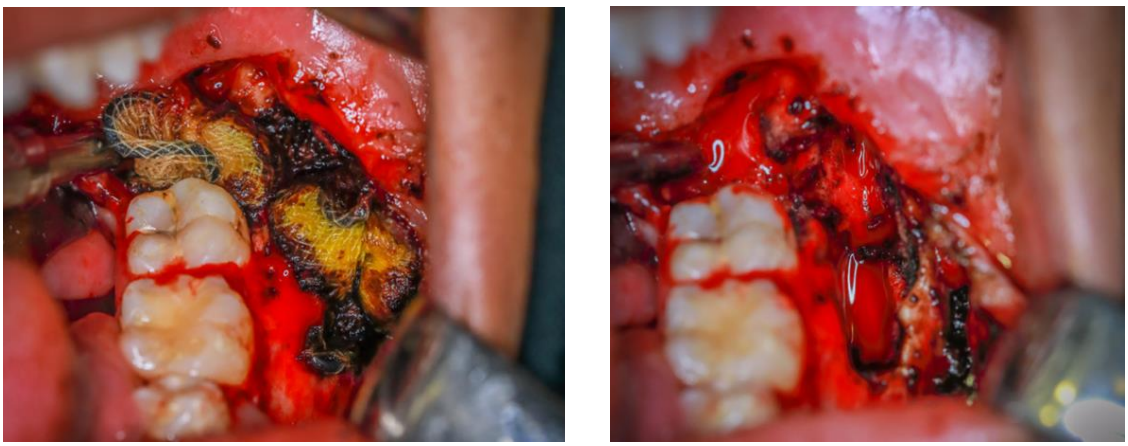

Figure 6. Upon KCOT removal, Carnoy's solution was applied to the bony bed of the lesion and left in place for 3 minutes.

Figure 7. Six months after the second stage enucleation with Carnoy's solution application.

KEY MESSAGE
Any thermoplastic medical tube can be used, depending on the required diameter, such as an intravenous infusion line, nasogastric tube, or surgical suction pipe [23 Level III].

4. Marsupialization: Another frequently utilized method for treating large OKC is marsupialization, followed by enucleation in the second surgery. It results in significant reduction of Ki-67 and IL-1α mRNA expression in these lesions. As IL-1α exerts osteolytic activity, the decreased expression of this interleukin contributes to the effects of marsupialization [21 Level II].

However, vital surrounding anatomical structures, such as the inferior alveolar nerve, needed to be protected due to the potential toxicity. Finally, cryotherapy has been used to target surrounding tissues to eliminate microcysts. Studies indicate that this procedure can be effective even in recurrent cases, as its freezing capabilities can induce cell death in tissues up to a depth of 1.5 mm [22 Level III].

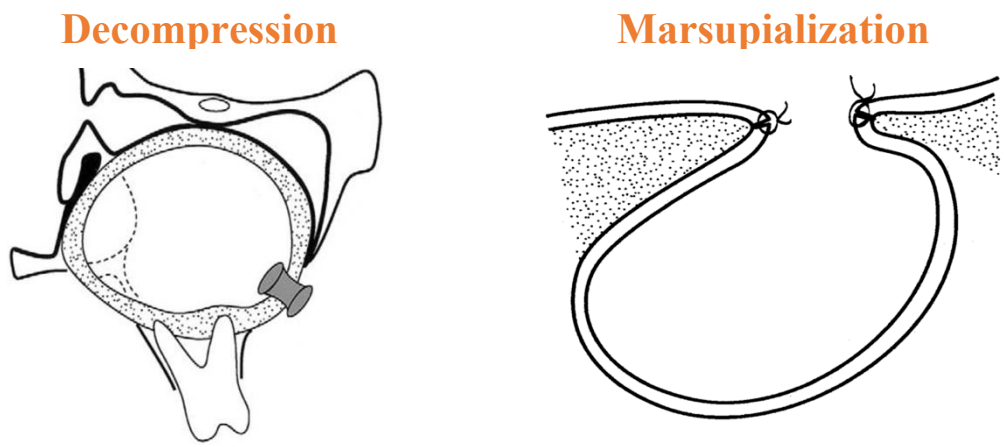

Figure 8. Diagrammatic representations of a maxillary cyst decompression into the oral cavity with a drainage tube in place; marsupialization, where the cyst mucosa is sutured to the oral mucosa [24 Level III].

VII. COMPLICATION

Complications associated with OKCs may include:

KEY MESSAGE
- For an OKC with accessible margins, enucleation along with adjunctive methods is preferred.
- For a large OKC, initial decompression should be performed, followed by enucleation if necessary.

- **Recurrence**: OKC has a notable propensity to recur following surgical treatment. High recurrence rate if not completely removed, often necessitating further surgical intervention. Multiple recurrences are common. While many OKCs recur within 5 years of the initial surgery, some recurrences may not become apparent until 10 or more years after the original procedure. Therefore, long-term clinical and radiographic follow-up is essential.
- **Infection**: May occur post-operatively, leading to increased morbidity.
- **Bone Destruction**: Extensive lesions can lead to significant bone loss, requiring reconstructive surgery.

VIII. POST-OPERATIVE CARE

- **Pain Management**: Use of analgesics to manage discomfort.
- **Cold Compress**: Apply ice packs to the affected area during the first 24–48 hours to reduce swelling and manage pain. Apply for 15–20 minutes on, then 15–20 minutes off.
- **Hygiene Instructions**: Emphasis on oral hygiene to prevent infection.
- **Infection Management:** Antibiotics are often recommended to prevent infection in the first week following surgery, especially for larger cysts or more invasive surgeries. Amoxicillin or clindamycin (if allergic to penicillin).
- **Dietary Modifications**: Recommend a soft diet for the first few days to avoid trauma to the surgical site. Foods that are easy to chew (e.g., mashed potatoes, soups, yogurt) should be encouraged.

IX. FOLLOW-UP

- **First Follow-up**: Schedule a follow-up appointment within 7–10 days for suture removal, if applicable, and to check for signs of infection or complications.
- **Orthopantomogram**: Literature suggests that most recurrences will present the first 5 years after primary treatment. The recommended follow-up for OKCs is once a year the first 5 years postoperatively. As the recurrences or newly developed OKCs may also present late clinically, a follow-up every 2 years thereafter seems a reasonable policy. Pogrel recommended follow-up, primarily with orthopantomogram every 6 months for 2 years, every year for 5 years, and every 2 years for 10 years in asymptomatic patients [25 Level III].

- **Clinical Assessments**: Regular clinical examinations to monitor for signs of recurrence.
- **Management of Recurrence**: If recurrence is detected, further treatment options should be discussed, which may include additional surgical intervention.

KEY MESSAGE
Due to its high recurrence rate, OKC requires regular and diligent follow-up clinically as well as radiographically to detect any recurring lesions promptly, allowing for timely intervention. It is important to always keep in mind the potential for recurrence when managing OKC.

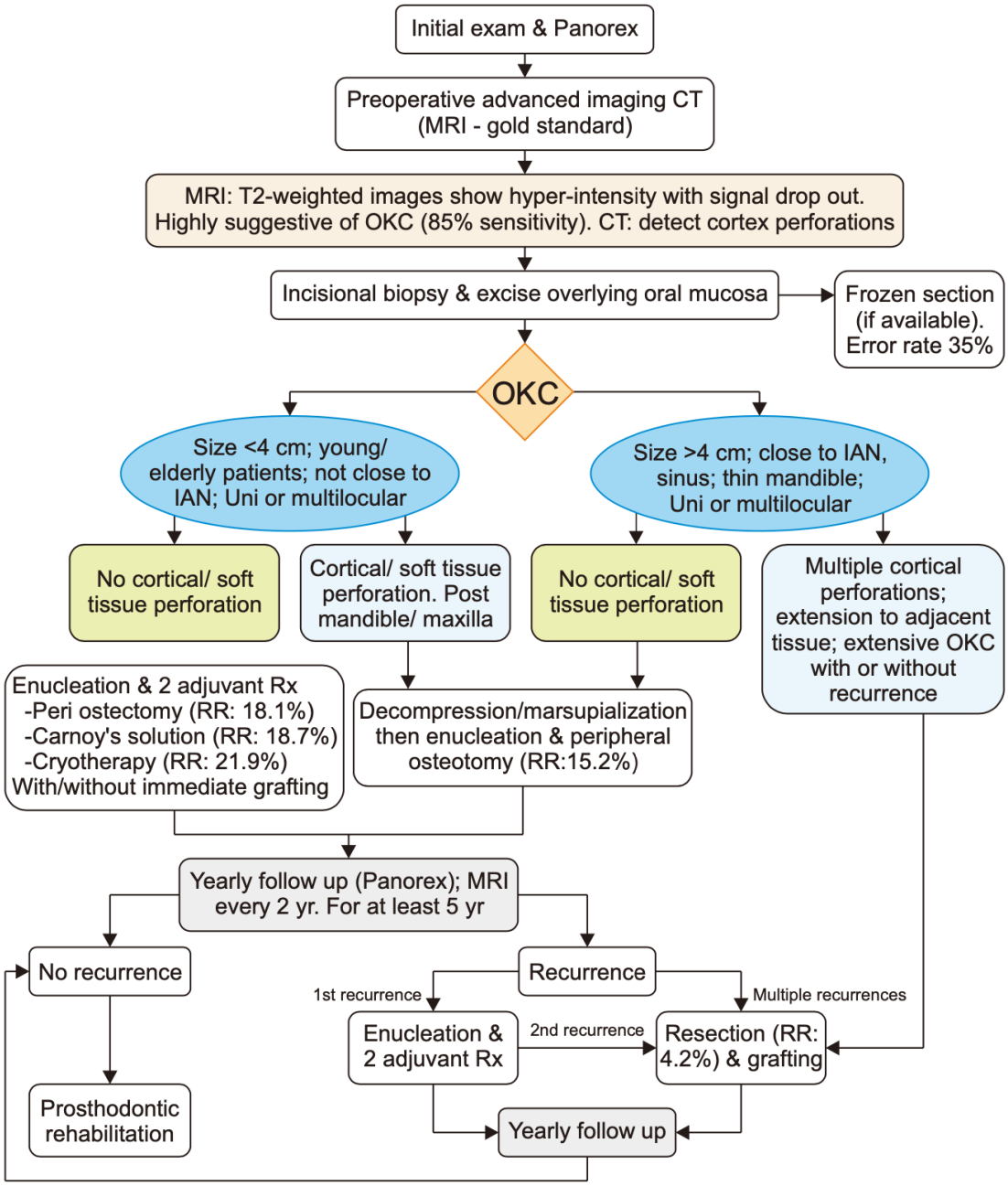

Figure 9. Management protocol for odontogenic keratocysts (OKC). (CT: computed tomography, MRI: magnetic resonance imaging, IAN: inferior alveolar nerve, Rx: treatment, RR: recurrence rates) [26 Level III].

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MANAGEMENT OF POST-OPERATIVE BLEEDING

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I. INTRODUCTION

Bleeding risks in dentoalveolar surgery are a critical consideration, particularly for patients on anticoagulant therapy or with conditions affecting hemostasis[5 Level III]. However, the excessive bleeding complicates surgery and may result in a higher risk of morbidity in dentistry. Although multiple evidence-based clinical guidelines regard dental interventions as minor procedures, with low risk of bleeding, patients on anticoagulation therapy are at elevated risk of bleeding complications, during and following dental surgeries[2 Level II-2]. In many instances, discontinuation or altering of anticoagulation can be avoided[3 Level II-3] through the use of local hemostatic agents during or after the procedure (or both)[3 Level II-3], while patients are therapeutically continued on their prescribed anticoagulant doses[1 Level III, 2 Level II-2]. In addition, patients with diagnosis of hereditary bleeding disorders, such as hemophilia, and individuals without any history of bleeding complications can present the need for the use of topical hemostatic agents[1 Level III,4 Level II-2].

II. DEFINITION

Bleeding is the loss of blood from the circulatory system. Causes can range from small cuts and abrasions to deep cuts and amputations. Injuries to the body can also result in internal bleeding, which can range from minor (seen as superficial bruising) to massive bleeds[1 Level III].

Bleeding disorders, also called as hemorrhagic disease, refers to a disease wherein the normal blood clotting mechanism is disrupted. The lack or abnormality in single or multiple clotting factors makes the patient vulnerable to excessive and prolonged bleeding[6 Level III]. Bleeding disorders can be classified as coagulation factor deficiencies, platelet disorders, vascular disorders or fibrinolytic defects [3,7 Level III.]

Bleeding disorder of unknown cause (BDUC) is a haematological diagnosis characterized by excessive bleeding in patients without a known aetiology[11 Level III].

III. ETIOLOGY

3.1 Local cause[1,5 Level III]:

- Soft tissue and
- hard tissue

3.2 Systemic cause[1 Level III, 3 Level II-3]:

Patient's with underlying medical conditions including blood disorder diseases, patient's taking anticoagulants or antiplatelet drugs.

Note: Common bleeding disorder (Table1)

Table 1: Type bleeding disorders[6 Level III]

Type of Bleeding Disorders	
Vascular disorders	Scurvy; Purpura; Hereditary hemorrhagic telangiectasia; Cushing syndrome; Ehlers-Danlos syndrome.
Fibrinolytic defects	Streptokinase therapy Disseminated intravascular coagulation
Platelet disorders	Quantitative disorder (thrombocytopenia) - Immune-mediated o Idiopathic o Drug-induced[6 Level III] o Collagen vascular disease o Sarcoidosis - Non-immune-mediated o Disseminated intravascular coagulation o Microangiopathic hemolytic anemia o Leukemia o Myelofibrosis Qualitative disorder

	- Congenital
	  o Glanzmann thrombasthenia
	  o von Willebrand's disease
	- Acquired
	  o Drug-induced[6 Level III]
	  o Liver disease
	  o Alcoholism

Coagulation factor deficiencies	Congenital - Hemophilia A and B - Von Willebrand's disease - Other factor deficiencies (rare) Acquired - Liver disease - Vitamin K deficiency, warfarin use - Disseminated intravascular coagulation

IV. DIAGNOSIS

4.1 Preoperative Assessment

4.1.1 Comprehensive Medical History:

Review the patient's systemic health, focusing on bleeding disorders, hepatic or renal diseases, and medications affecting hemostasis[1 level III].

4.1.2 History taking:

- Medical and dental history
- Family history of bleeding problem
- Excessive bleeding after tooth extractions or other surgeries
- Excessive bleeding after trauma, such as minor cuts and falls
- Patient bruise easily or have frequent nosebleeds
- Patient taking any mediations that affect bleeding, such as acetylsalicylic acid, commonly prescribed anticoagulants (e.g., warfarin [Coumadin],

enoxaparin [Lovenox], dabigatran [Pradaxa], rivaroxaban [Xarelto], and apixaban [Eliquis], heparin), herbal medications, chemotherapy, or antibiotics.

- Patient have any known illnesses that are associated with bleeding (e.g., hemophilia, leukemia, renal disease, liver diseases, cardia diseases).
- Spontaneous bleeding.

4.2 Clinical Features

4.2.1 Clinical feature of postoperative bleeding

- Oral signs may include[11 Level III]:
  - Oral/mucosal bleeding
  - Gingival bleeding in the absence of periodontal disease
  - Excessive bleeding following dental extractions

4.2.2 Clinical feature related with systemic cause:

- Bleeding disorder of unknown cause has a similar bleeding phenotype to other mild bleeding disorders including[11 Level III]:
  - Epistaxis
  - Haematuria
  - Haemarthrosis
  - Menorrhagia
  - Postpartum menorrhagia
  - Post-surgical/dental bleeding

4.3 Differential diagnoses of BDUC[11 level III]:

- Haemophilia
- Von Willebrand disease
- Platelet function disorder
- Connective tissue and vascular disorders
- Ascorbic acid deficiency

4.4 Laboratory Evaluation:

- Obtain coagulation profiles (INR, aPTT, platelet count) if the patient has a bleeding tendency or is on anticoagulants[1 Level III, 2 Level II-2].
- **Note: Test to evaluate hemostasis** [7,8 ,10Level III]

- Platelet count (PC)
  - Provides a quantitative evaluation of platelet function
  - Normal: 150,000- 450,000/mm^3
- Bleeding time (BT)
  - Measures the time for hemostatic plug formation (measure the function of the platelets)
  - Normal Bleeding time: <7minutes (by simplate); 1-6 minutes (modified lvy's test)
  - Prolonged in:
    - Thrombocytopenia
    - Thrombocytopathy
    - Liver disease
    - Von-Willebrand's disease
    - Taking medication; Aspirin, Clopidogril (Plavix)
- Clotting time (CT)
  - Measures the time required for the formation of first clot.
  - Normal Clotting time: 4 -14 minutes
  - Is screening test for coagulation disorders
  - Is increased due to absence or abnormality of clotting factors.
- Prothrombin time (PT)[8Level III]
  - Time in seconds that is required for fibrin threads to form in citrated or oxalated plasma (measure the integrity of clotting factors)
  - Normal time: 11-14 seconds; or 12-15 seconds
  - Measured against a Control PT in terms of INR

INR = PT Test / PT Normal

- Normal INR = 1; Abnormal INR > 1.5
- Normal Therapeutic INR (2-3), patient of high-intensity anticoagulation (2.5-3.5)

Table 2: Target INR ranges [8 Level III]

Target INR.	Condition
2-3	Deep vein thrombosis pulmonary embolis Atrial fibrillation Stroke (venous)

3-4	Prosthetic heart valves

- Measures extrinsic and common pathways = Factors VII, X, V, II, I
- Increased PT in:
    - Patients on Warfarin Therapy
    - Vitamin K deficiency
    - Early and End Stage Liver failure

- Partial Thromboplastin time (PTT)
    - Time in seconds that's required for a clot to form in citrated or oxalated plasma (measure the integrity of clotting factors)
    - Performance indicator of both the intrinsic and common pathways
    - Typical reference range: 30-40 seconds
    - Increased PTT seen in:
        1. Patients on Heparin therapy
        2. Von-Willebrand's disease
        3. Early stage Liver failure/ Wilson's disease
        4. Hemophilia

V. MANAGEMENT

5.1. Medication Management:

Collaborate with physicians regarding use of anticoagulants and antiplatelet agents.

Consider temporary modification or continuation based on the bleeding risk versus thromboembolic risk assessment[1,2 Level III].

5.2 Type of hemorrhage

5.2.1 Primary hemorrhage

This occurs during surgery, as a result of injury from cutting or laceration of the artery or bleeding from bone or when the surgery is done in an infected are with a lot of granulation tissue. However, it will last for a very short period of time immediately after the surgery[1 Level III].

5.2.2 Intermediate hemorrhage

This type of bleeding occurs as a result of failure of coagulation as in patients with systemic bleeding disorders or patient's taking anticoagulants or antiplatelet drugs (Table2).

Table 2: Bleeding risk for dental procedure[7 Level III]:

Dental procedures that are unlikely to cause bleeding	Dental procedures that are likely to cause bleeding	
	Low risk of post-operative bleeding complications	Higher risk of post-operative bleeding complications
Local anaesthesia by infiltration, intraligamentary or mental nerve block[a]. Local anaesthesia by inferior dental block or other regional nerve block[a,b]. Basic periodontal examination (BPE) [c] Supragingival removal of plaque, calculus and stain Direct or indirect restorations with supragingival margins Endodontics and other prosthetics procedures	Simple extractions[d] (1-3 teeth, with restricted wound size) Incision and drainage of intraoral swellings Detailed six-point full periodontal examination Root surface debridement (RSD) Direct or indirect restorations with subgingival margins	Complex extractions[e], adjacent extractions that will cause a large wound or more than 3 extractions at once Flap raising procedures[f] including: - Elective surgical extraction - Periodontal surgery - Preprosthetic surgery - Crown lengthening - Dental implant surgery Gingival recontouring Biopsies[f]

Fitting and adjustment of orthodontic appliances		

Note:

a. Local anesthesia should be delivered using aspirating syringe and should include a vasoconstrictor, unless contraindicated. Note that other methods of local anaesthetic delivery are preferred over regional nerve blocks, whether the patient is taking an anticoagulant or not.

b. There is no evidence to suggest that an inferior dental block performed on an anticoagulated patient poses a significant risk of bleeding. However, for patients taking warfarin, if there are any indications that the patient has an unstable INR (see Section 6), or other signs of excessive anticoagulation, an INR should be requested before the procedure to ensure <4 before proceeding.

c. Although a BPE can result in some bleeding from gingival margins, this is considered extremely unlikely to lead to complications.

d. Simple extractions refers to those that are expected to be straightforward without surgical complications.

e. Complex extractions refers to those that may be likely to have surgical complications.

f. Consideration should be given to the extent and invasiveness of the individual procedure. Some may be less invasive and could be treated as low risk.

Key message 1: Advice for assessing bleeding risk

- Assess whether the required dental treatment is likely to cause bleeding and if so, whether it is low or high risk.
- Ask the patient about their current or planned use of anticoagulants or antiplatelet drugs and other medications, when taking or confirming their medical history.
- Ask the patient if their anticoagulants or antiplatelet treatment is lifelong or a limited time.
- Ask the patient about any medical conditions that they have.
- Ask the patient about their bleeding history.

5.3 Hemostatic measures

The arrest of bleeding is a core skill for primary dental practitioners should have the necessary equipment and skills to perform appropriate local hemostatic measures competently for dental procedures likely to cause bleeding[1 Level III]. These include packing any open sockets with hemostatic material and placing sutures. Suturing may be used to stabilize the clot, packing material and wound margins, unless it is likely to cause further trauma[1 Level III].

For all patients taking anticoagulants and antiplatelet drugs, hemostasis should be achieved using local measures prior to the patients being discharged from care[2 Level II-2]. Active consideration should be given to suturing and packing, taking into account all relevant patient factors. These may include the drug or drug combination that the patient is taking, other medical conditions or medication that may impact on bleeding and the travel time for the patient to access emergency care if required[2 Level II-2]. Failure of initial hemostasis will necessitate packing and suturing at a later time[1 Level III].

The dental practitioner should have available:

- Absorbent gauze
- Hemostatic packing materials (collagen sponge, oxidized cellulose, bone wax)
- Suture kit (needle holders, tissue forceps, suture materials, scissors)

5.4 Local cause management

Key message 2: Advice for controlling bleeding [1 level III]

- Mechanical methods: Applying pressure with gauze or cotton pledges soaked in tranexamic acid can be effect.
- Surgical technique: Suturing, cauterization, and ligation of bleeding vessels are also used.
- Local measures: Rest, elevation of the head, and avoiding strenuous activity can help minimize bleeding and promote healing.

+ **Management (Key message 2)**:
  - Mechanical Methods
  - Surgical techniques
  - Local measures

+ **Medication and Instrumentation Need:**
  - Cotton bud
  - Topical anesthetic cream
  - Local anesthetic with adrenaline, dental syringe, dental needles
  - Helper to retract tongue, cheek
  - Sterile dental mirror
  - Sterile tweezers
  - Sterile cotton gauze
  - Sterile suture kit (needle holders, tissue forceps, suture materials, scissors)
  - 3.0 plain gut suture
  - Absorbent gauze
  - Hemostatic packing materials (collagen sponge, oxidized cellulose, bone wax)

+ **Procedure**
  - Topical anesthetic over injection site with cotton bud. Wait 1 minute
  - Inject local anesthetic with adrenaline into surrounding soft tissue
  - Wipe dry, remove any large clots, look for torn tissue or source of bleeding
  - Put in suture by pushing needle right through soft tissue only from outside to inside of socket, then from inside to outside of socket.

- Pull socket sides towards each other, knot and cut gut
- Hemostatic packing materials; If gelatins sponge (eg Gelfoam) available
  - Tweezers to gently push into socket and under suture to hold in place.
- Watch for 10 minutes

Note: If still bleeding

1. Reapply finger pressure and gauze pack
2. Recheck medical history and consult with Physician.
3. If Haemophilia's patient:

Recommended use of tranexamic acid:

- An adult dose of 1g three to four times per day.
- Paediatric dose of 25mg/kg three to four times per day
- (standard mouthwash solution of 500mg crushed and dissolved in 10ml of saline may also be used)
- Young children may be offered ice to suck (eg and icy pole).
- Regular paracetamol will help to control the pain
- Evaluation and Follow up

KEY MESSAGE Normal Bleeding - Light oozing for 1-2 hours - Pink-tinged saliva - Small, stable clots - Gradually decreasing	KEY MESSAGE Concerning Bleeding - Heavy flow soaking gauze every 15 minutes - Bright red blood continuously - Large clots repeatedly forming and falling out - Increasing over time

KEY MESSAGE

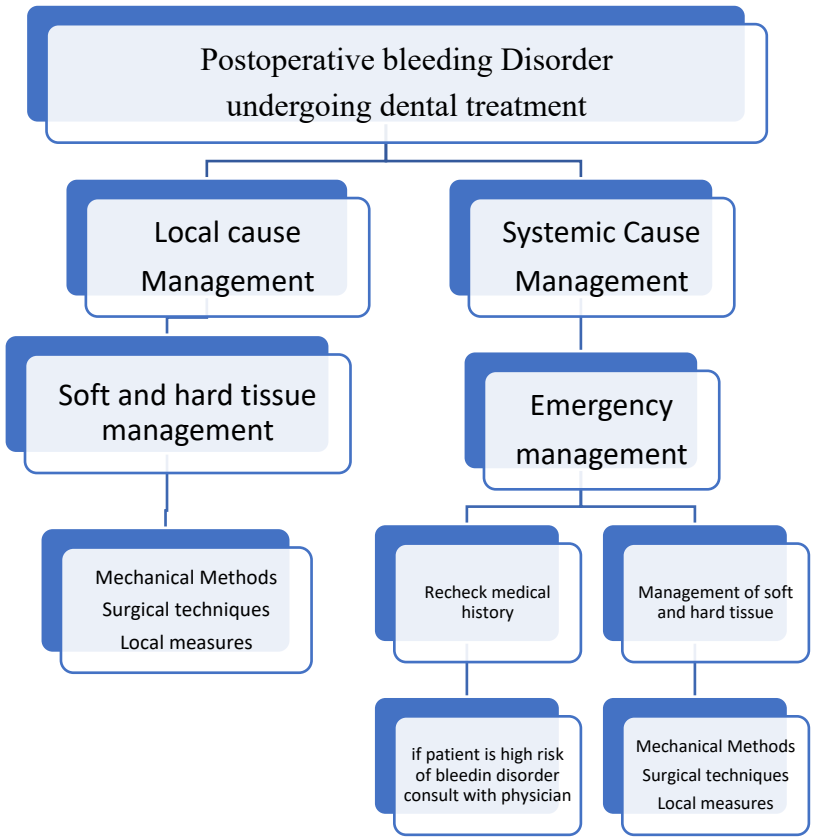
Warning Signs and When to Seek Help:

- **Persistent bleeding beyond 12 hours:**
  - Is the most common red flag. If you've tried proper pressure techniques for two full cycles and blood is still actively flowing (not just light oozing). It's time to call us.
  - Your body should have formed a stable clot by this points, and continued bleeding may indicate a deeper issue.
- **Swelling that affects your breathing or swallowing:**
  - Requires immediate emergency care
  - While some facial swelling is normal after extraction, swelling that extends to your neck or makes it difficult to breathe needs urgent medical attention. Don't wait-head to the emergency room if you experience these symptoms.
- **Signs of infection:**
  - Typically appear after the first 24-48 hours and include fever, foul taste in your mouth, or pain that gets worse instead of better after day three.
  - These symptoms often indicate secondary bleeding, which occurs when bacteria interfere with the healing process.
- **Severe dizziness or feeling faint:**
  - From blood loss means you've lost more blood than your body can easily replace
  - This is especially concerning if you've also experiencing rapid heartbeat, nausea or confusion

5.4 Management of patients in remote and rural locations

Patient living in remote and rural locations may have to travel for longer to access primary dental care or secondary care in those very rare circumstances when a severe bleeding complication occurs. The individual circumstances should be taken into consideration for patients in remote and rural settings and particular emphasis should be placed on the use of measures to avoid complications. In addition, extended post-operative monitoring of the patient before discharge is advisable. As with all patients, attitude to risk and bleeding complications[2] Level II-2 should be discussed and given due consideration when agreeing treatments[3] Level II-3.

VI. ALGORITHM



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Chapter 2:

Oral Medicine

1. **Recurrent Aphthous Stomatitis**

RECURRENT APHTHOUS STOMATITIS

Ping bushara[1], Cheang Pengleang[2], Phan Sandeth[2]

I. INTRODUCTION

Recurrent aphthous stomatitis (RAS) is one of the most common oral mucosal diseases, characterized by recurrent ulcers in the mouth that cause pain and discomfort with affecting up to 25% of the worldwide population[(1),Level II-3] . This guideline outlines the clinical approach to diagnosis, etiology, and management of RAS. It aims to provide a structured process for healthcare professionals to diagnose and manage patients effectively.

II. DEFINITION

Recurrent aphthous stomatitis (RAS) refers to the recurring formation of painful ulcers, or aphthae, inside the mouth, usually without a known systemic disease association. These ulcers typically affect non-keratinized mucosa and occur in three forms[(2)(3), Level II-2]:

- Minor aphthous ulcers (most common, < 1 cm) prevalent (70%-80%)
- Major aphthous ulcers (larger and deeper) prevalent (10%)
- Herpetiform ulcers (small, clustered) prevalent (10%)

III. ETIOLOGY

The exact cause of RAS is still unclear, but several factors may contribute(4):

- Genetic predisposition
- Immune dysregulation
- Nutritional deficiencies (e.g., vitamin B12, iron, folate)
- Allergic reactions (to food or oral hygiene products)
- Hormonal changes
- Stress and trauma
- Infections (bacterial, viral)
- Systemic diseases (such as inflammatory bowel disease, Behçet's disease)

IV. DIAGNOSIS

4.1 History Taking

A comprehensive medical and dental history is crucial. Key elements include:

- Frequency, duration, and recurrence pattern of ulcers
- Family history of similar lesions
- Past medical history (nutritional deficiencies, gastrointestinal diseases, immunodeficiencies)
- Triggering factors (trauma, stress, specific foods)
- Medications taken
- Systemic symptoms (fever, weight loss, gastrointestinal symptoms)

4.2 Clinical Examination

- Extraoral Examination:
  Look for any associated systemic signs such as skin lesions, ocular symptoms, or genital ulcers, which may suggest a systemic condition like Behçet's disease.
- Intraoral Examination:
  Examine the location, size, and characteristics of the ulcers. Aphthous ulcers typically appear on non-keratinized mucosa, such as the labial, buccal, or ventral tongue areas.

4.3 Minor aphthous ulcers

- The lesions are typically small,< 5 mm in diameter
- Oval or round in shape. They tend to occur in clusters of 1 to 6 ulcers at a time. Halo erythematous and covered by a greyish-white pseudomembrane.
- Form on non-keratinized mucosal surfaces, such as the buccal and labial mucosa and the floor of the mouth,
- Heal within two weeks without leaving scars.

4.4 Major aphthous ulcers

- The ulcers are larger, typically greater than 10 mm in diameter.
- Persist for 5 to 10 weeks, often resulting in scarring.
- Occurred any part of the oral cavity, including the oropharynx.
- This type of RAS is most common in patients with AIDS, gastrointestinal and hematological disorders[(5),Level III].

4.5 Herpetiform ulcers

- The name is derived from its similarity to primary herpetic stomatitis, although there is no association with herpes viruses.
- These ulcers are painful, small, and can be numerous, with up to 100 ulcers occurring at the same time. They measure between 2 to 3 mm in diameter and typically last for one to two weeks.
- Common sites include the floor of the mouth and the tongue, especially the tip and lateral margins.
- The ulcers may develop on either keratinized or non-keratinized mucosa. In some cases, the small ulcers merge into a larger, irregular ulcer, which may heal with scarring.

4.5 Investigation

- Complete blood count (CBC)
- Serum levels of vitamins (B12, folate) and minerals (iron)
- Tests for systemic diseases (as indicated by history and examination)

- Tissue biopsy (in atypical or persistent cases)

4.4 Differential Diagnosis

Consider the following conditions[4, Level III]:

- Herpes simplex virus infection **(Refer to Herpes simplex virus section)**
- Erythema multiforme
- Celiac disease
- Crohn's disease
- Oral Erythroplakia **(Refer to Oral Leukoplakia and Erythroplakia)**
- Behçet's disease
- Cyclic neutropenia
- PFAPA (periodic fever, aphthous stomatitis, pharyngitis, adenitis) Syndroms
- Mouth and genital ulcers with inflamed cartilage (MAGIC) syndrome.

4.5 Prognosis

In most cases, RAS is self-limiting and non-life-threatening. Patients may experience recurrent episodes over months or years, but the frequency and severity often decrease with age.

Minor RAS lesions usually heal within 2 weeks without leaving scars, while Major RAS lesions are more prolonged, taking up to 6 weeks to heal and often leaving scars. Herpetiform ulcers typically resolve within a month[4, Level III]. Proper management can significantly reduce discomfort and improve quality of life.

V. MANAGEMENT

- **Topical Treatments**
  - Topical corticosteroids (e.g., triamcinolone, clobetasol)
  - Topical antiseptics (e.g., chlorhexidine mouthwash)
  - Topical anesthetics for pain relief (e.g., benzocaine gel)

RECOMMENDATION	GRADE
The topical agents are the first option of the treatment of RAS. It should be applied in a small amount of gel or cream after rinsing, and avoid eating or drinking for 30 minutes. This can be repeated 3 or 4 times daily.	C

- **Systemic Treatments**
  - Short term systemic corticosteroids (for severe episode of major aphthous ulcers)[(2), Level II-2]
  - Immune-modulating agents (e.g., colchicine, dapsone, azathioprine)
  - Nutritional supplementation (vitamin B12, iron, folate)
  - Any lesion that does not respond to treatment after two weeks should be referred to an oral and maxillofacial surgeon for further evaluation and possible biopsy to rule out other underlying conditions, such as malignancies or systemic diseases
  - Herpetiform ulceration is typically treated similarly to minor aphthous ulcers. This includes the use of topical corticosteroids, antiseptic mouthwashes, and pain relief medications to manage symptoms and promote healing. In more severe cases, systemic treatments may be considered.

RECOMMENDATION	GRADE
Systemic agents are indicated for severe and constantly recurring RAS when the topical management is not effective.	**C**

- **Low Level Laser Therapy (LLLT)**
  - Produce analgesia
  - Stimulate the healing process
  - Reduce the healing period
  - Relatively safe with no clinical complications because of the low energy output
    - Wavelength from 630 to 1100 nm
    - Power between 2 and 200 mW

RECOMMENDATION	GRADE
• Despite of reduction in pain score and healing time of RAS after the application of LLLT, clinical applications are inconsistent possibly owing to a lack of comprehension of how dosage is affected by physical and anatomic penetration characteristics.	**C**
• LLLT provides better effect on pain reduction, aphthous size and duration, and acceleration of the healing process.	**C**

- **Lifestyle Modification**
  - Stress management strategies
  - Avoidance of known triggers (certain foods, trauma, allergens)
  - Proper oral hygiene regular dental cleaning and polishing
- **Patient Education**
  - Oral hygiene education, inform patients about the chronic nature of RAS
  - Emphasize the importance of regular follow-ups, especially if symptoms worsen or systemic signs emerge.
  - In the active phase of RAS, patients should steer clear of hot, spicy, acidic, and salty foods, as well as excessive fatigue, lack of sleep, and overexertion.
  - Healthy lifestyle, including appropriate nutrition, exercise, and rest,
  - All RAS patients must be closely followed up every 3 to 6 months until no recurrence occurs for at least a year.[6] Level II-2

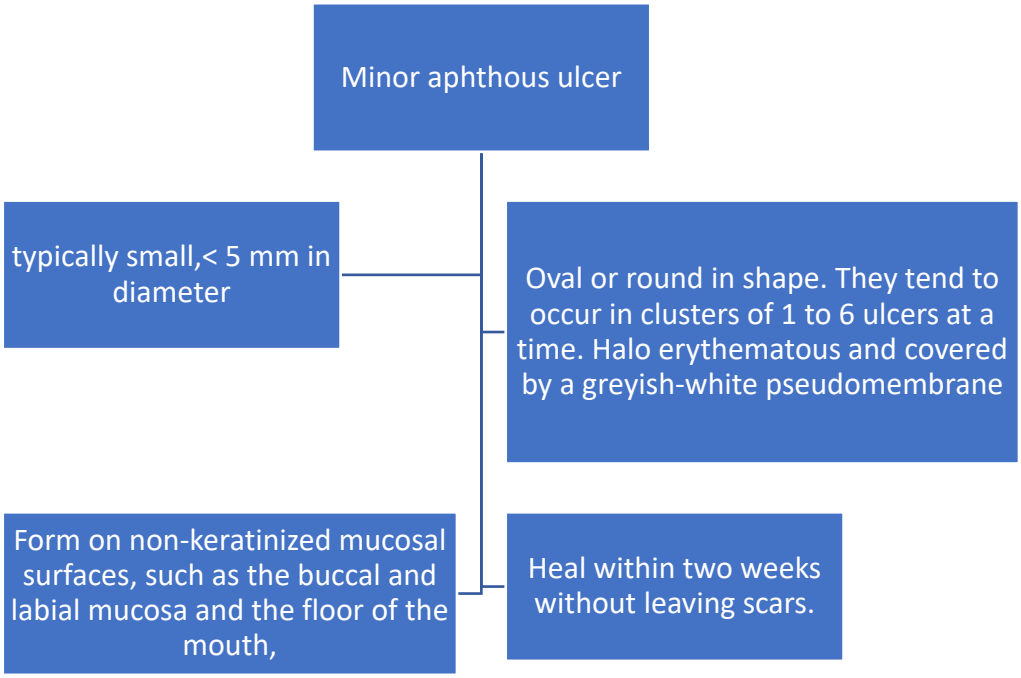
Key messages:

Key message 4
- Early recognition and tailored treatment are essential to managing discomfort and preventing recurrence. - Both local and systemic treatment options should be considered based on the severity of the condition. - Addressing underlying nutritional deficiencies and lifestyle factors can improve outcomes.

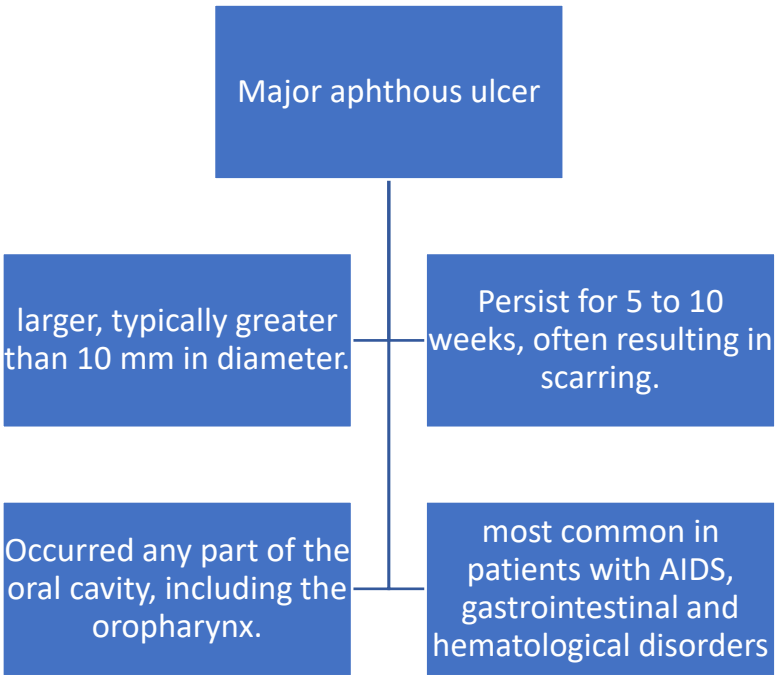
VI. ALGORITHM

Diagnosis

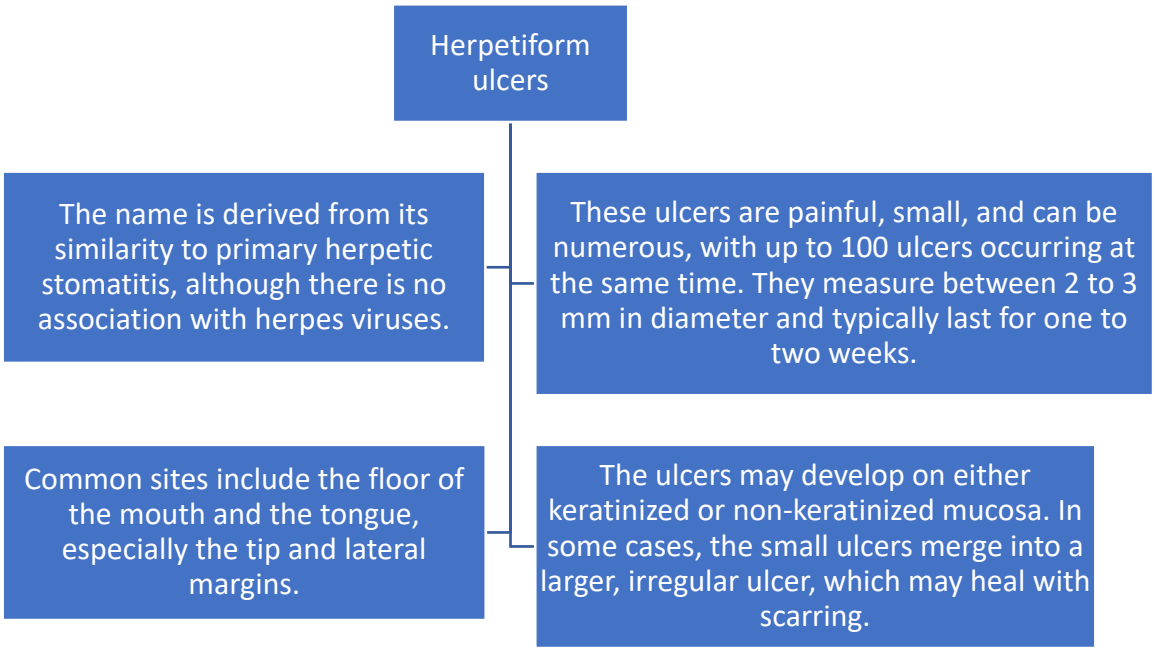
- **Minor aphthous ulcer**



- **Major aphthous ulcer**

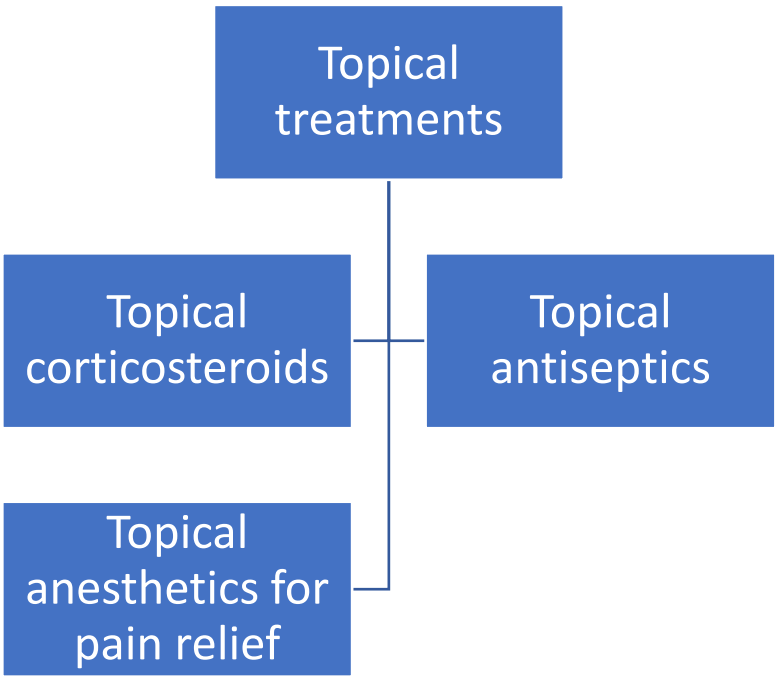


- **Herpetiform ulcers**

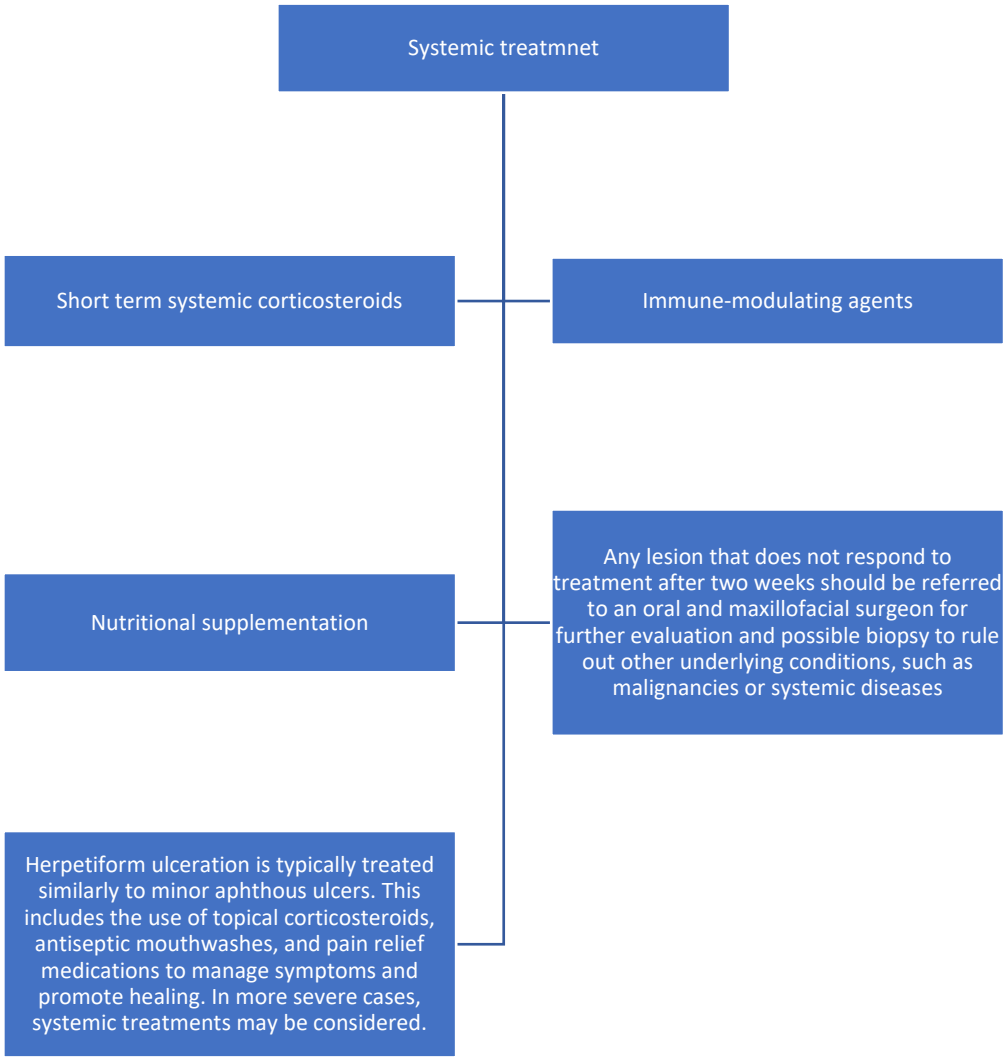


Management

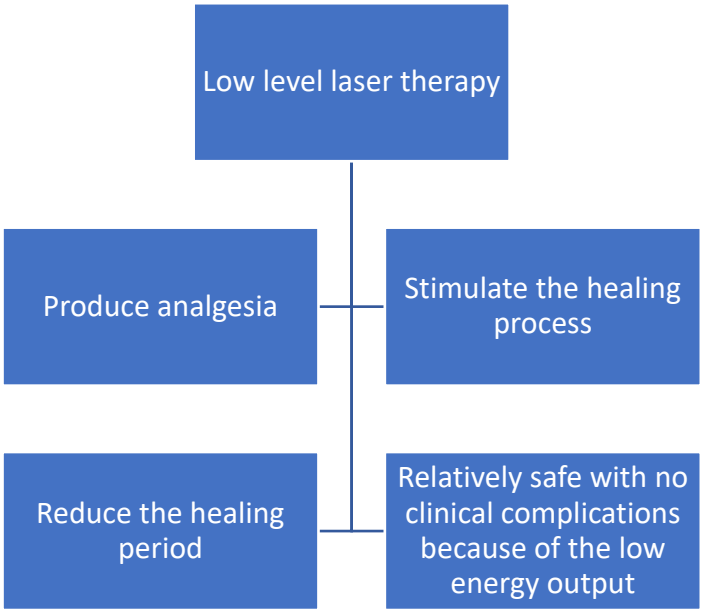
- **Topical treatments**



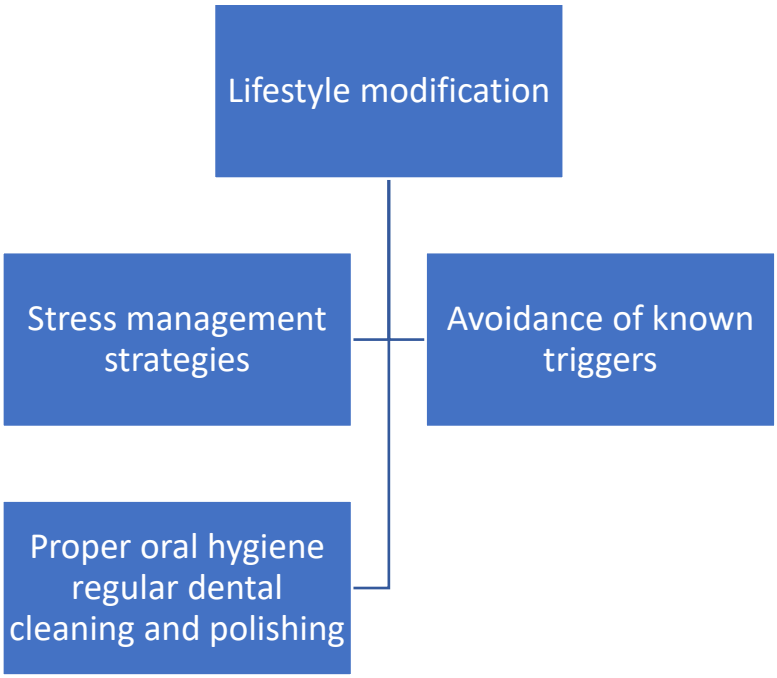
- **Systemic treatment**



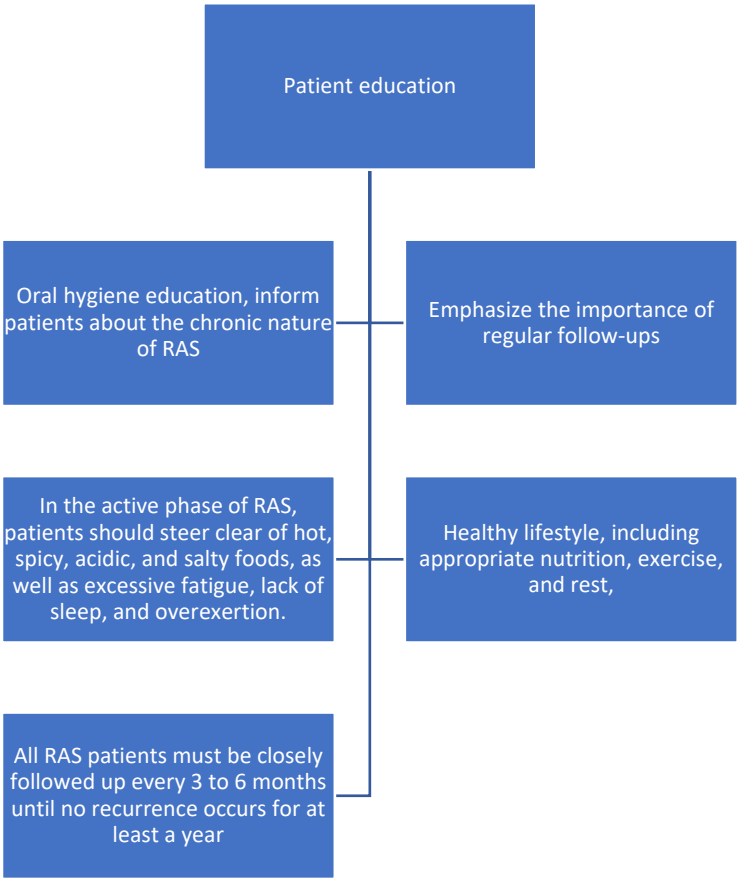
- **Low level laser therapy (LLLT)**



- **Lifestyle modification**



- **Patient education**



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Chapter 3:

Periodontics

2. Management of Periodontitis

MANAGEMENT OF PERIODONTITIS

SOK Chea, KONG Sophannary, TAK Ranuch, and KHORN Sophea

I. INTRODUCTION

Periodontal disease is one of the most prevalent oral condition worldwide affecting nearly 50% of adults [1 Level II-2], with 19% of the population in 2019 suffering from severe periodontitis, and significantly contributes to the overall global disease burden[2 Level III]. Severe periodontitis adversely affects the quality of life (QoL) of adults[3 Level I] as it particularly leads to pain, functional limitations, and physical and psychological disabilities. It is also linked to challenges in social life, harming personal and professional relationships due to bad breath and noticeable changes in the appearance of the affected teeth[4 Level III]. Across different populations, the average rate of periodontitis progression remains largely consistent. However, there is evidence that certain groups within these populations experience varying degrees of disease advancement[5 Level III]. The periodontal status of Cambodians increased with age as indicated by both Community Periodontal Index (CPI) or a clinical attachment loss (CAL). Calculus was the most common finding among Cambodians pointing to overall poor oral hygiene levels. A report from 2014 revealed that 12.3% of Cambodian subjects had one or more sextants with ≥4 mm pocket depth and ≥6 mm CAL[6 Level II-2].

II. CASE DEFINITION

Periodontitis is a chronic multifactorial inflammatory disease associated with dysbiotic microbial plaque biofilms (dental plaque) and characterized by the progressive destruction of the tooth-supporting structures (periodontium), with primary features being clinical attachment loss (CAL), radiographically assessed alveolar bone loss, presence of periodontal pockets and bleeding[7 Level III].

According to the new classification of periodontal conditions (2017), there is no evidence of a specific pathophysiology that enables the differentiation of cases as “aggressive” or “chronic” periodontitis or provides guidance for different kinds of intervention[8 Level III]. Based on pathophysiology, periodontitis can be classified into three distinct forms (Appendix 1):

- Necrotizing periodontitis
- Periodontitis associated with systemic diseases

- Chronic or general periodontitis

Periodontitis is characterized further by defining the stage and grade of the disease to capture the complexity of individual cases. The stages reflect the severity and extent of the disease, while the grades indicate the expected rate of progression[9 Level III]. Therefore, the present guideline focus on the management of periodontitis, which involves regularly assessing patients for bleeding on probing (BOP) and periodontal pocket depth (PPD), and necessary interventions including supra and subgingival scaling or other periodontal treatment modalities.

KEY MESSAGE
A new periodontitis classification scheme has been adopted, in which forms of the disease previously recognized as "chronic" or "aggressive" are now grouped under a single category ("**periodontitis**") and are further characterized based on a multidimensional staging and grading system. The **stages** reflect the severity and extent of the disease, while the **grades** indicate the expected rate of progression.

III. ETIOLOGY AND RISK FACTORS

Current evidence suggests that multiple factors influence various immunoinflammatory responses that lead to progressive destruction of periodontium[7,12 Level III; 10,11 Level II-2]. The factors that promote periodontal disease include:

- **Biofilm dysbiosis**: Continued accumulation of supra- and subgingival polymicrobial biofilm triggers a persistent immune response within the periodontium. When the balance between the oral microbiome and the host's immune system is disrupted—whether by microbial or inflammatory stimuli—dysbiosis is perpetuated, leading to a cycle of worsening periodontitis. The dysbiotic changes in the microbiome, making some patients more susceptible to severe forms of the disease than others[13 Level II-1].

The microbes involved in periodontal disease are largely gram-negative anaerobic bacilli with some anaerobic cocci and a large quantity of anaerobic spirochetes. The main organisms linked with deep destructive periodontal lesions are *Porphyromonas gingivalis, Prevotella intermedia, Bacteroides forsythus, Actinobacillus actinomycetemcomitans* and *Treponema denticola*[14 Level III].

- **Uncontrolled host responses** from other factors such as:

- Heredity[15 Level II-1] or genetic factor[16 Level III]
- Systemic diseases[17 Level III]:
  - Chronic inflammatory diseases including rheumatoid arthritis (RA)[18. Level II-2; 19 Level I], inflammatory bowel disease (IBD)[20 Level II-2], Diabetes[21 Level III], respiratory disease, autoimmune condition;
  - Alzheimer's disease[23 Level II-2]
  - Cancer [24 Level III]
  - Immune-modulating virus including HIV[24 Level III], Covid-19 [25 Level II-2; 26 Level III]
- Habit and social factors:
  - Smoking[27 Level I]
  - Alcohol[28 Level I]
  - Unhealthy diet and high carbohydrate consumption[29 Level I]
- Medications (Immunosuppressive such as cyclosporine; corticosteroids such as methylprednisolone and prednisone; antiepileptic drugs such as phenytoin; calcium channel blockers such as nifedipine, verapamil, diltiazem, amlodipine; tricyclic antidepressants)[30-31 Level III]
- Psychological stress[32-33 Level III] paralleled by elevated cortisol release, emotional stress, etc.

KEY MESSAGE
When the balance between the oral microbiome and the host's immune system is disrupted—whether by microbial or inflammatory stimuli—dysbiosis is perpetuated, leading to a cycle of worsening periodontitis. This makes some patients more susceptible to severe forms of the disease than others. (See Appendix 5)

IV. DIAGNOSIS (Appendix 4)

KEY MESSAGE
Evaluation of periodontal status requires relevant information on:
- History taking
- Clinical examination
- Investigation

1. History taking

- General history
  - Age (e.g., periodontitis cases are usually old patients)[1 Level II-2]
  - Gender (e.g., Women, when they have menstruation and pregnancy the hormonal changing and result is gingival inflammation)[34 Level III]
  - Family history of periodontal disease
  - Religion and cultural (impact on the diagnosis, management)
  - Social status (relate with socio-economic status and oral hygiene)
  - Occupation (Stress)
- Medical and dental history
  - To identify pre-disposing conditions such as diabetes mellitus, hypertension, smoking, uses of specific medications [1*] and other conditions (i.e. Malaria, HIV) that impact conventional dental therapy.
  - Chief complaint, history of complaint or reason for the visit such as bleeding gums during brushing or eating, loss teeth, spacing or spreading of the teeth, abscesses in the gums or gingival suppuration, food impaction or tooth sensitivity in response to temperature changes, gingival recession (black triangles between teeth) or tooth mobilities, gnawing feeling or itching in the gingiva, gingival swell or inflammation.

2. Clinical examination

- Examination of extra-oral structures include the assessment of skin, face, lymph nodes, odors from body and breath, and joints[2*] and muscles of the head and neck region.
- Examination of intra-oral tissues[3*]

[1*] A false-positive BOP may occur in patients taking oral anti-coagulants, antithrombic agents, non-steroidal anti-inflammatory drugs (NSAIDs), or daily dose of aspirin as low as 81mg. In contrast, patients taking daily doses of corticosteroids or those recently using antibiotics may present with minimal BOP even in the presence of periodontitis.

[2*] There is no direct link between TMJ pain and periodontitis; however, condylar erosion is the most common radiographic change in TMJ of RA patients, and the co-morbidity of periodontitis and rheumatoid arthritis (RA) is well recognized[18 Level II-2] .

[3*] Intraoral photograph can record the visual reality of oral status that are difficult to record in words. In addition, malalignment, attrition and soft tissue morphological abnormalities are examined in a study model.

- Signs of suppuration, swelling, presence and distribution of calculus and plaque.
- Condition of teeth (caries/pulpal status/abnormal tooth position and/or morphology tooth mobility, furcation involvement[35 Level III] and restorations (non-fitted /over contours/ over- hanging).
- Signs of occlusal trauma and para-functional habits[36 Level III].

- Clinical features[37 Level III]:
  - Interdental CAL[4*] is detectable at ≥2 non-adjacent teeth, or
  - Buccal/oral CAL of ≥3mm with pocketing of >3mm is detectable at ≥2 teeth

NOTE: Basic Periodontal Examination (BPE) is recommended for general practitioners to initially evaluate the periodontal condition. It is recommended to do in the first visit, and annually check-up. In the process of BPE, clinician must use periodontal probe (WHO probe) to indicate the depth of the periodontal pocket of each tooth by gently doing walking probe. BPE guides the need for further diagnostic measures before establishing a definitive periodontal diagnosis and appropriate treatment planning (See Appendix 2).

Table 1. Characteristics of Periodontal Health, Gingivitis and Periodontitis[38 Level III]

	Health	**Gingivitis**	**Periodontitis (Figure I)**			
			Stage I (Mild)	Stage II (Moderate)	Stage III (Severe)	Stage IV (Very severe)
BOP	<10%	≥10%	>10%			
PPD	≤3 mm	≤3 mm	<4 mm	≥4 to <6 mm	≥ 6 mm	≥ 6 mm
Interdental CAL (at site of greatest loss)	No	No	1 – 2 mm	3 – 4 mm	≥5 mm	≥5 mm
Radiological bone loss	No	No	Coronal third (<15%)	Coronal third (15% - 33%)	Extending to middle third of root	Extending to middle third of root and beyond

[4*] Clinical attachment loss (CAL) is calculated by a circumferential assessment of the erupted dentition with a standardized periodontal probe with reference to the cementoenamel junction (CEJ).

					(Vertical defects ≤3mm)	(Vertical defects ≥3mm)
Furcation Involvement					Class I or II	Class I or II
Mastication					Function is preserved	Dysfunction-need for complex rehabilitation
Ridge					Moderated ridge defect	Severe ridge defect
Tooth Loss (due to periodontitis)					≤ 4 teeth	≥5 teeth
Occlusal						Secondary occlusal trauma, Mobility ≥2
Note: **Localized: <30% of teeth;** **Generalized: ≥30% of teeth;** **Molar/incisor pattern**						

3. **Investigation**

- Recommendation radiographic for periodontitis are as follows:
  - Intraoral periapical radiographs (PA)
  - Bitewing radiographs (PBWs)
  - Orthopantomograms (OPG
  - Cone-beam computed tomography (CBCT)
- Alveolar bone loss should be radiographically assessed to determine the stage of periodontitis as below:

- Stage I: Radiographic bone loss < 15% in coronal third of the root, mostly horizontal
- Stage II: Radiographic bone loss 15% to 33% in coronal third of root, mostly horizontal
- Stage III: Radiographic bone loss extending to middle third of root
    - Vertical defects ≥ 3 mm
    - Furcation involvement grade II and III
    - Moderate ridge defect
- Stage IV: Radiographic bone loss extending to middle third of root and beyond
    - Vertical defects ≥ 3 mm
    - Furcation involvement grade II and III
    - Severe ridge defect

1. Differential diagnosis

Periodontitis should be differentiated from the following clinical conditions:

- Gingivitis[39 Level III]
- Vertical root fracture[36 Level III]
- Cervical decay[36 Level III]
- Cemental tears[36 Level III]
- External root resorption lesions[36 Level III]
- Tumours or other systemic conditions extending to the periodontium[36 Level III]
- Trauma-induced local recession[36 Level III]
- Endo-periodontal lesions[40 Level III]
- Periodontal abscess[40 Level III]
- Necrotizing periodontal diseases[40 Level III]

V. MANAGEMENT

An essential prerequisite to therapy is to inform the patient of the diagnosis, including causes of the condition, risk factors, treatment alternatives and expected risks and benefits including the option of no treatment. This discussion should be followed by agreement on a personalized care plan. The plan might need to be modified during the treatment journey, depending on patient preferences, clinical findings and changes to overall health.

Sequences for management of periodontitis is suggested as shown in page 15. Basically, it starts from examinations, diagnosis, risk assessment, initial therapy (guiding behaviour change, removal of supragingival dental biofilm and risk factor control), cause-related therapy, corrective therapy and supportive periodontal care (SPC)[41 Level III].

All periodontitis cases should receive initial therapy, and if unsuccessful, a referral may be necessary. Patients with complicating factors, especially those struggling with behavior change, may need to be escalated to the next level of care. Supporting evidence will be required for referrals in such cases. For patients with Grade C periodontitis, a referral should be made after providing preventive advice on managing risk factors and giving oral hygiene instructions[42 Level III].

RECOMMENDATION

If expertise is not available or referral is not an option, we recommend repeated scaling and root debridement with or without open flap of the area in the context of high-quality Initial therapy and Cause-related Therapy and a frequent program of supportive periodontal care including subgingival instrumentation.

Grade A

Periodontal risk assessment should be implemented in all periodontitis patients, irrespective of the stage of their disease, and should be re-evaluated frequently in order to:

- Continue to build motivation and adherence, or explore other alternatives to overcome the barriers
- Develop skills in dental biofilm removal and modify as required
- Allow for the appropriate response of the ensuing steps of therapy

1. The first step: Initial therapy

The first step in therapy is aimed at guiding behaviour change by motivating the patient to undertake successful removal of supragingival dental biofilm and risk factor control and may include the following interventions:

- Supragingival dental biofilm control

- Interventions to improve the effectiveness of oral hygiene [motivation, instructions (oral hygiene instructions, OHI)]
- Adjunctive therapies for gingival inflammation
- Professional mechanical plaque removal (PMPR), which includes the professional interventions aimed at removing supragingival plaque and calculus, as well as possible plaque-retentive factors that impair oral hygiene practices.
- Risk factor control, which includes all the health behavioural change interventions eliminating/mitigating the recognized risk factors for periodontitis onset and progression (smoking cessation[5*], improved metabolic control of diabetes, and perhaps physical exercise, dietary counselling and weight loss).

Periodontitis patients may benefit from diabetes control interventions to improve periodontal treatment outcomes and the maintenance of periodontal stability. These interventions consist of patient education as well as brief dietary counselling and, in situations of hyperglycaemia, the patient's referral for glycaemic control[44 Level I].

Physical exercise (activity) interventions may improve both treatment and the long-term management of chronic non-communicable diseases. In periodontitis patients, the promotion may consist of patient education and counselling tailored to the patients' age and general health. These interventions may consist of patient education including brief dietary advices (mainly addressing lower fat intake, less free sugars and salt intake, increase in fruit and vegetable intake) and in specific cases patient's referral to a nutrition specialist[44 Level I].

RECOMMENDATION

Periodontal risk assessment should be performed as part of clinical evaluation of patient with periodontitis. Intervention for risk factor control is recommended as part of the first step of periodontal therapy.

Grade A

[5*] Patient's current self-reported smoking status should be noted at every regular recall appointment. It is also important to make note of the historic burden of smoking for instance in number of packs of cigarettes smoked per day[43 Level III].

Table 1. Risk Assessment, Prevention and Management of Periodontal Disease[45 Level III]

	Definition	Preventive and periodontal treatment administration flow	Recall interval
Low Risk	BOP: 0-9% 4mm < maximum 4 pockets Loss of maximum 4 teeth Periodontal bone loss (%)/patient's age: ≤0.5 Smoking: No Genetic/Systemic: No	• Oral hygiene motivation/ instructions • If necessary, regular dental prophylaxis	1/ year
Moderate Risk	BOP: 10-25% 4mm < 4-8 pockets Loss of 4-8 teeth Periodontal bone loss (%) /patient's age ≤ 0.5-1.0 Smoking: Maximum of 10/ 10-19 cigarettes per day Genetic/Systemic diseases: No	• Oral hygiene motivation/instructions • Determining periodontal disease risk factors • Smoking cessation interventions • Regular dental prophylaxis and subgingival curettage (Scaling and root planning)	2/year
High Risk	BOP: >25% 4mm < minimum 8 pockets Loss of minimum 8 teeth Periodontal bone loss/Patient's age >1.0	• Oral hygiene motivation • Determining and eliminating periodontal disease risk factors • Smoking cessation interventions • Diabetes control intervention (Dietary	3-4/year

	Smoking: one or more packs of cigarettes per day Genetic/Systemic disease: Present	counselling and/or patient's referral for glycaemic control) • Consultation with periodontist	

2. The second step: Non-Surgical Periodontal Therapy

The second step of therapy (also known as cause-related therapy) is aimed at the elimination (reduction) of the subgingival biofilm and calculus by removing irritants (food debris, restoration overhang, unsmoothed restoration, etc.) from the surface and root of the tooth that promote plaque retention. In this guideline, the procedure "subgingival instrumentation" refers to all non-surgical procedures (subgingival debridement, subgingival scaling, root planning, etc.), either performed with hand (i.e. curettes) or in combination with power-driven (i.e. sonic/ultrasonic devices). The reduction of pockets and improving level of attachment are better achieved in moderate to deep periodontal pockets after scaling and root planning[46 Level I].

While similar results were obtained for both of these in the removal of plaque and calculi, there was less root surface damage with ultrasonic scalers used at medium power than hand or sonic scalers. In addition, powered sub-gingival debridement requires less time than manual instrumentation. Furcation involvements, root grooves and infrabony pockets may also be more accessible with specific ultrasonic tips than manual scalers due to less instrument width in the former[47 Level III]. Care should be taken not to over-instrumentation.

RECOMMENDATION

Subgingival instrumentation for patients with periodontitis, any of the following procedures can be performed:

- Conventional staged debridement
- Full mouth scaling and root planning

Grade B

Subgingival instrumentation has traditionally been delivered during multiple sessions (e.g. quadrant-wise). As an alternative, full-mouth protocols have been suggested.

Quadrant-wise staged debridement at usually 1-2 weeks interval is the conventional practice of treating periodontitis patients. Full-mouth protocols included single stage and two-stage therapy within 24 hours.

Adjunctive antiseptics may be considered, specifically chlorhexidine mouth rinses twice daily for 1 minute for 2 weeks, in periodontitis therapy, as adjuncts to mechanical debridement, in specific cases[48 Level III]. The choice of treatment should be based on patient preference and clinical workload since there is insufficient evidence of the superiority of either method[49 Level I].

Current evidence indicates that adjunctive laser therapy (two main wavelength categories of 2,780–2,940 and 810–980 nm) offers a superior short-term effect in in reducing pockets depth in periodontitis patients, with benefits observed up to 6 months[50 Level III;51 Level I], and comparable compared to the SRP alone at 24 months in patients with chronic periodontitis[52 Level I].

As part of informed consent, patients should be made aware of any potential side effects of periodontal treatment. These might include:

- Increased gingival recession
- longer-looking teeth (especially if there are deep pockets anteriorly)
- Increasing gaps between the teeth (black triangles)
- Increased sensitivity
- Food packing
- Unwanted effects from antiseptic mouthrinse (if Chlorhexidine is used) including staining, burning sensation during use.

3. The third step: Surgical Periodontal Therapy

RECOMMENDATION

Subgingival instrumentation for patients with periodontitis, any of the following procedures can be performed:

- Conventional staged debridement
- Full mouth scaling and root planning

Grade B

The individual response to the second step of therapy should be assessed after an adequate healing period (periodontal re-evaluation). If the endpoints of therapy (no periodontal pockets >4 mm with bleeding on probing or deep pockets [≥6 mm]) have not been achieved, the third step of therapy should be implemented. If the treatment has been successful in achieving these endpoints of therapy, patients should be placed in a SPC program[41 Level III]. Surgical approaches are subject to specific, additional patient consent and specific risk factors/presence of medical contra-indications should be considered.

Periodontal surgery reduces or eliminates periodontal pockets and creates an acceptable gingival form that will facilitate effective oral hygiene and periodontal maintenance[53 Level I]. It also improves access and facilitates root debridement in areas of deep probing depths and roots that present elusive anatomic features such as flutings, grooves, concavities and furcations, where scaling and root planning alone has been found to be inadequate[54 Level III; 55 Level II-1].

Currently, clinical evidence supporting the use of Er:YAG lasers and Er,Cr:YSCG lasers for promoting periodontal wound healing and tissue regeneration remains limited and insufficient[56 Level III]. High-power laser therapy (HLLT) as an alternative to conventional instrumentation can significantly control postoperative pain more effectively compared to conventional periodontal treatment, and intraoperative or postoperative photobiomulation (PBM) effect of lasers combined with surgical periodontal therapy can significantly suppress pain[57 Level I].

a. Surgical procedure

The following are the common periodontal surgical procedures[41,58 Level III]:

- Open-flap debridement (OFD)
- Resective therapy
  - Flaps with or without osseous surgery
  - Root resective surgery
  - Gingivectomy
- Regenerative therapy:
  - Guided bone regeneration (GBR)
  - Guided tissue regeneration (GTR)
  - Combined regenerative techniques

In cases of deep (PPD ≥ 6 mm) residual pockets in patients with Stage III periodontitis after an adequate second step of periodontal therapy, we suggest using resective periodontal surgery, yet considering the potential increase of gingival recession. Treating teeth with residual deep pockets associated with intrabony defects ≥3 mm with periodontal regenerative surgery is recommended[59 Level I]. For molars with residual pockets associated with mandibular and maxillary buccal Class II furcation involvement, periodontal regenerative therapy using enamel matrix derivative (EMD) alone or bone-derived graft with or without resorbable membranes is recommended[60-61 Level I]. In mandibular Class III and multiple Class II furcation involvement in the same tooth, nonsurgical instrumentation, OFD, tunneling, root separation or root resection may be considered[60 Level I].

b. Postoperative health education

Health education on the following areas should be provided to postoperative patients[62 Level III]:

- Discomfort and the potential complications; including bruising, soreness, limitation in mouth opening and hypersensitivity[63 Level III].
- Unwanted effects from antiseptic mouthrinse (if Chlorhexidine is used) including staining, burning sensation during use.
- All medication, especially analgesics and antibiotics if prescription is necessary.
- Diet modification including avoidance of hot(/heat) or spicy food and liquids.
- Smoking reduction, especially during the healing period.
- Home care instruction.

c. Adjunctive antimicrobial therapy

RECOMMENDATION

Due to concerns about patient's health and the impact of systemic antibiotic use to public health, its routine use as adjunct to subgingival debridement in patients with periodontitis is not recommended.

Grade A

The adjunctive use of specific systemic antibiotics may be considered for specific patient categories (e.g. generalized periodontitis Stage III in young adults).

Grade C

Antibiotic therapy should not be considered as routine, and if antibiotic is needed, it should be given as an adjunct to periodontal therapy[64 Level I] for the following patients:

- Not responding to conventional mechanical therapy.
- Acute periodontal infection associated with systemic manifestations.
- Medically compromised.
- Supplement in selected patients undergoing non-surgical and surgical periodontal therapy[65 Level III]

Antimicrobial photodynamic therapy (aPDT) at wavelength ranges of either 660–670 nm or 800–900 nm can be considered a safe adjunctive method to conventional mechanical therapy for treating periodontal diseases and eliminating periodontal pathogens[65 Level III]. The clinical efficacy of different aPDT protocols compared to conventional non-surgical methods of treatment for periodontitis with the majority reporting improvements in clinical parameters[66 Level III].

d. Extraction

Early extraction of teeth with questionable (as opposed to hopeless) prognosis is strongly discouraged and is not supported by current evidence[58 Level III]. Class II and III furcation involvement is not reason for extraction[41 Level III]. Extractions may be considered for hopeless teeth upon patient evaluation and during the course of treatment to facilitate prosthodontic-driven treatment plans. This discussion should be followed by agreement on a personalized care plan[41,58 Level III;] .

4. Supportive Periodontal Care (SPC)

KEY MESSAGE

Supportive periodontal therapy should include:

- An update of the medical and dental history,
- Dental examination,
- Radiographic review,
- Evaluation of the patient's oral hygiene performance,
- Periodontal evaluation and risk assessment.

Periodontal maintenance or supportive periodontal care is recommended at intervals of 3 to a maximum of 12 months and ought to be tailored according to patient's risk profile and periodontal conditions after active therapy[41,58 Level III]. SPC including individual behaviors is crucial for long-term periodontal stability and potential further improvements in periodontal status[67 Level III].

Supportive periodontal care should include an update of the medical and dental histories, examination of extra and intraoral soft tissues, dental examination, radiographic review, evaluation of the patient's oral hygiene performance, periodontal evaluation and risk assessment, with supra and subgingival removal of bacterial plaque and calculus, and retreatment of disease when so indicated[67 Level III].

We do not recommend flossing as the primary option for interdental cleaning in patients undergoing periodontal maintenance. For interdental areas that cannot be reached by a toothbrush, we advise complementing tooth brushing with other interdental cleaning tools

RECOMMENDATION
Supportive treatment visits should be performed every 3-6 months and be tailored to patients' risk factors for periodontal disease progression.
Grade B

RECOMMENDATION
If an antiseptic mouth rinse formulation is going to be adjunctively used, we suggest products containing chlorhexidine, essential oils and cetylpyridinium chloride for the control of gingival inflammation, in periodontitis patients in supportive periodontal care.
Grade B

for these patients. The use of antiseptics may be considered in specific cases to help control gingival inflammation in patients receiving supportive periodontal care. However, it is unclear whether other adjunctive agents, such as probiotics, prebiotics, anti-inflammatory agents, or antioxidant micronutrients, are effective in managing gingival inflammation in these patients[41 Level III].

5. Rehabilitation

Extensive destruction of periodontal tissue requires a systematic approach to determine the possibilities and expectations of the patient, since the long-term results of treatment will depend on the full cooperation of the patient and consistent periodontal maintenance care[68 Level III]. Implants replacing teeth lost due to periodontitis have been found to have lower survival rates and more biological complications than those replacing teeth lost

due to other reasons[69-70 Level II-2]. Definitive treatment to reinstate function, speech and aesthetics usually starts after conclusion of initial or surgical corrective therapy, to allow time for consolidation of periodontal tissue.

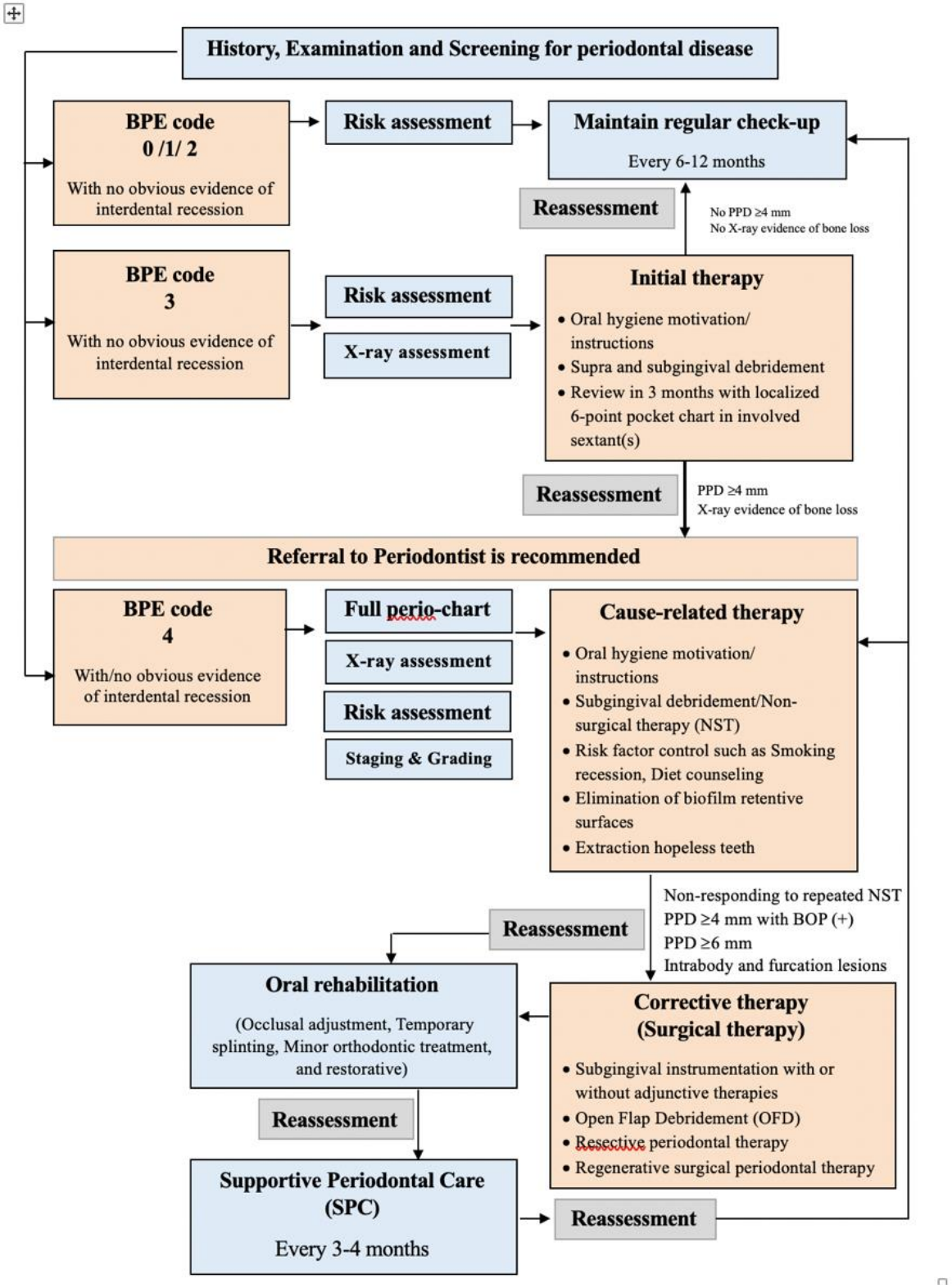
KEY MESSAGE

Rehabilitation of patients with periodontitis involves multidisciplinary approach.

Dental implants can be placed in periodontally compromised patients who have successfully undergone periodontal therapy.

Patients with combination of a history of treated periodontitis and smoking must be warned of the increased risk of implant failure.

VI. ALGORITHM FOR MANAGEMENT OF PERIODONTITIS



VII. APPEDICES

Appendix 1

Table 3. Forms of Periodontitis[7] Level III

FORM OF PERIODONTITIS
1- Necrotizing Periodontal Disease (Herrera et at. 2018)
a. Necrotizing Gingivitis b. Necrotizing Periodontitis c. Necrotizing Stomatitis
2- Periodontitis as Manifestation of Systemic Disease (Jepsen, caton et al. 2018 consensus Rept Albandar et al. 2018)
Classification of these condition should be based on the primary systemic disease according to the international statistical classification of Diseases and Related Health Problems (ICD) codes
3-Periodontitis (Fine et al. 2018, Needleman et al. 2018, Billings et al. 2018)
a. Stages: Based on Severity and Complexity of Management Stage I: Initial Periodontitis Stage II: Moderate Periodontitis Stage III: Severe Periodontitis with potential for additional tooth loss Stage IV: Severe Periodontitis is with potential for loss of the dentition b. Extent and distribution: localized; generalized; molar-incisor distribution c. Grades: Evidence or risk of rapid progression, anticipated treatment response i. Grade A: Slow rated of progression ii. Grade B: Moderate rate of progression iii. Grade C: Rapid rate of progression

Table 4. New Classification System for Periodontitis[8-9 Level III]

Periodontitis stage and grading (Adapted from Tonetti et al.2018)[7 Level I]					
Framework for Periodontitis staging and grading		**Disease Severity and Complexity of Management**			
		Stage I: Initial periodontitis	**Stage II:** Moderate Periodontitis	**Stage III:** Severe periodontitis with potential for additional tooth loss	**Stage IV:** Advanced periodontitis with extensive tooth loss and potential for loss of dentition
Evidence or risk of rapid progression, anticipated treatment response, and effects on systemic health	Grade A	Individual Stage and Grade Assignment			
	Grade B				
	Grade C				
Periodontitis Stage		**Stage I**	**Stage II**	**Stage III**	**Stage IV**
Severity	Interdental CAL at site of greatest loss	1 to 2 mm	3 to 4 mm	≥ 5mm	≥ 5mm
	Radiographic Bone loss	Coronal third <15%	Coronal third <15% to 33%	Extending to mid-third of root and beyond	Extending to mid-third of root and beyond
	Tooth loss	No tooth loss due to periodontitis		Tooth loss due to periodontitis of ≤ 4 teeth	Tooth loss due to periodontitis of ≥ 5 teeth
Complexity	Local	Maximum probing depth ≤ 4mm mostly horizontal bone loss	Maximum probing depth ≤ 5mm mostly horizontal bone loss	In addition to stage II complexity: – Probing depth ≥6 mm – Vertical bone loss ≤3mm – Furcation involvement Class II or III – Moderate ridge defect	In addition to stage III complexity: Need for complex rehabilitation due to: – Masticatory dysfunction – Secondary occlusal trauma (tooth mobility degree ≥2) – Severe ridge defect – Bite collapse, drifting, flaring – Less than 20 remaining teeth (10 opposing pairs)
Extent and distribution	Add to stage as descriptor	For each stage, describe extent as localized (<30% of teeth involved), generalized≥ 30% teeth, or molar/incisor pattern			

Periodontitis grade			Grade A: Slow rate of progression	Grade B: Moderate rate of progression	Grade C: Rapid rate of progression
Primary Criteria	Direct evidence of progression	Longitudinal data (RBL or CAL)	Evidence of no loss over 5 years	<2 mm over 5 years	≥2 mm over 5 years
	Indirect evidence of progression	% bone loss/age	< 0.25	0.25 to 1.0	>1.0
		Case phenotype	Heavy biofilm deposits with low levels of destruction	Destruction commensurate with biofilm deposits	Destruction exceeds expectation given biofilm deposits; specific clinical patterns suggestive of periods of rapid progression and/or early onset disease (e.g., molar/ incisor pattern; lack of expected response to standard bacterial control therapies)
Grade modifiers	Risk factors	Smoking	Non-smoker	Smoker <10 cig/day	Smoker ≥10 cig/day
		Diabetes	Normoglycemic/no diagnosis of diabetes	HbAlc <7.0% in patients with diabetes	HbAlc ≥7.0% in patients with diabetes

Example cases of periodontitis at different stages:

Stage I periodontitis

Stage II periodontitis

Stage III periodontitis

Stage IV periodontitis

Figure 3. Periodontitis at different stages

Appendix 2

The Basic Periodontal Examination (BPE) requires that the periodontium be examined with a standardized periodontal probe (WHO probe) using light pressure to examine for bleeding on probing, plaque retentive factors and pocket depth.

All the teeth present are to be examined in six sextants, four posterior sextants and two anterior sextants. The worst score of each sextant is scored.

Table 2. Basic Periodontal Examination (BPE) code

Code	Definition	Treatment need
0	No bleeding on probing, no calculus, no overhand, no pocket depth reaches beyond 3.5 mm	Oral health instruction (OHI) Dietary advice
1	Bleeding on probing, no calculus, no overhang, no pocket depth reaches beyond 3.5 mm	OHI Dietary advice Scaling and root planing (non-surgical)
2	Supra-gingival and sub-gingival calculus is indicated, no pocket depth reaches beyond 3.5 mm	OHI Dietary advice Scaling and root planing (non-surgical)
3	Pocket depth is indicated 3.5 to 5.5 mm	OHI Dietary advice Scaling and root planing (non-surgical) 6-point pocket chart in that sextant is required X-ray should be considered (in order to establish if there is attachment loss)
4	Pocket depth is indicated more than 5.5 mm	OHI Dietary advice Full mouth periodontal examination + X-rays Refer to specialist (Periodontist)
*	Furcation involvement is indicated	OHI Dietary advice Full mouth periodontal examination + X-rays Refer to specialist (Periodontist)

All new patients should have the BPE recorded

- For patients with codes 0, 1 or 2, the BPE should be recorded at every routine examination
- For patients with BPE codes of 3 or 4, more detailed periodontal charting is required
- **Code 3:** Initial therapy including self-care advice (oral hygiene instruction and risk factor control) then, post-initial therapy, record a 6-point pocket chart in that sextant only
- **Code 4:** If there is a Code 4 in any sextant then record a 6-point pocket chart throughout the entire dentition (Full mouth periodontal examination)

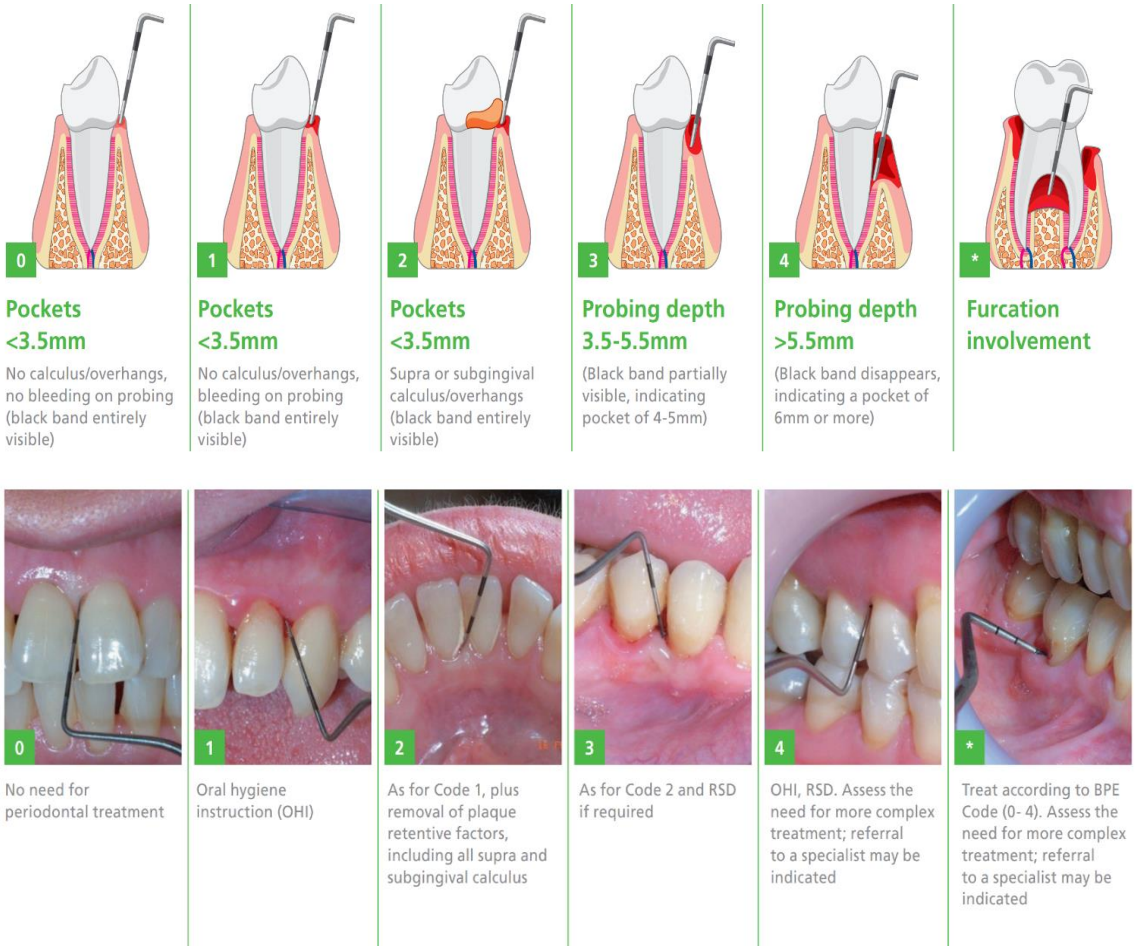


Figure 4. Scoring code (adapted from British Society of Periodontology, 2019)

BPE cannot be used to monitor the response to periodontal therapy because it does not provide information about how sites within a sextant change after treatment. To assess the response to treatment, a 6-point pocket chart should be recorded pre and post- treatment.

For patients who have undergone initial therapy for periodontitis, and who are now in the maintenance phase of care, then full probing depths throughout the entire dentition should be recorded at least annually.

An example BPE score grid might look like this:

4	3	3*
-	2	4*

Both the number and the * should be recorded if a furcation is detected.
E.g. the score for a sextant could be 3* (indicating a probing depth 3.5-5.5mm plus a furcation involvement in the sextant

Appendix 3

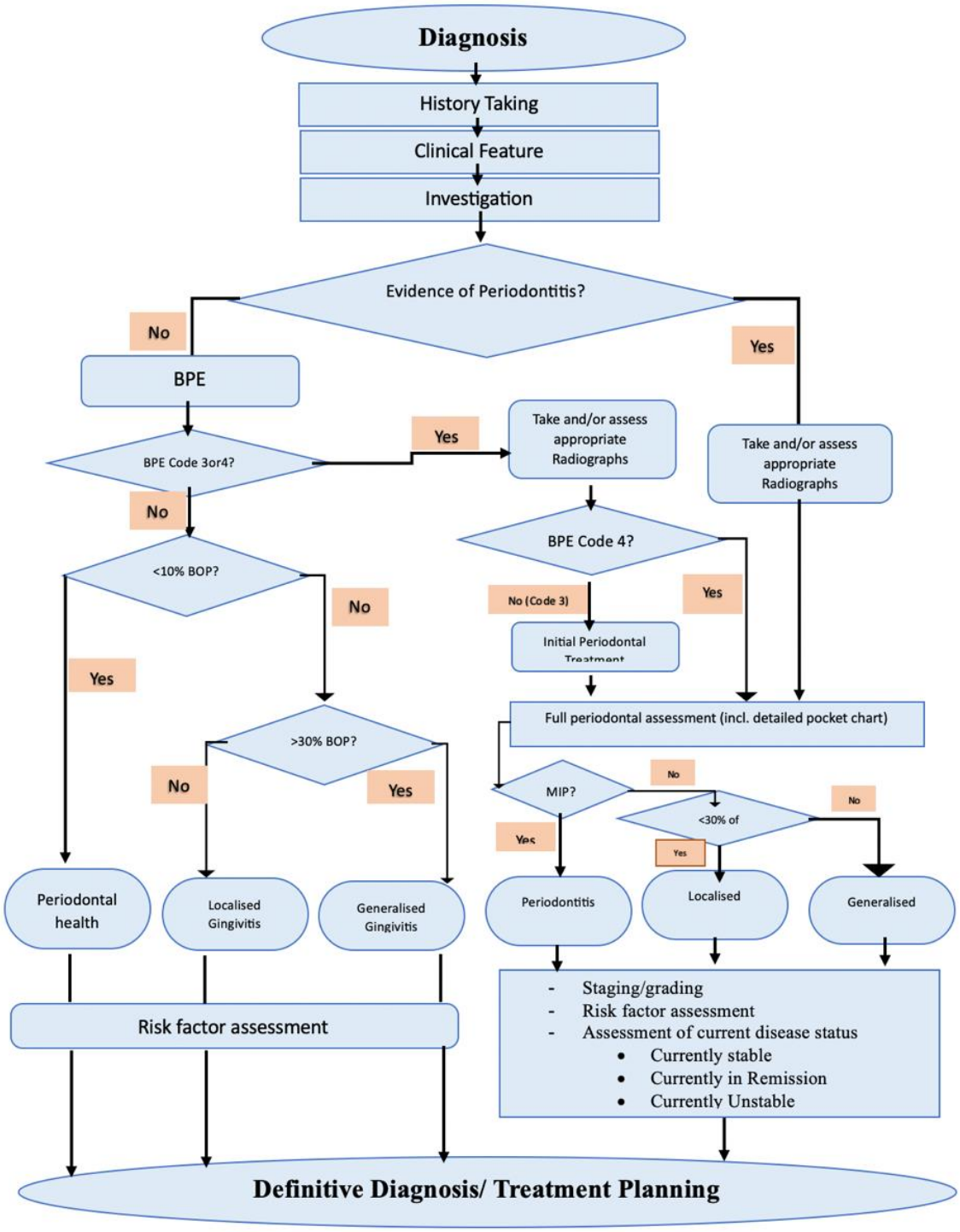


Figure 3. Standard procedures for periodontitis diagnosis and treatment planning

Appendix 4

Table 3. Risk Assessment, Prevention and Management of Periodontal Disease

	Definition*	Preventive and Periodontal Treatment Administration Flow	Monitoring Process
Low Risk	BOP: 0-9% PPD: 0-4 TL: 0-4 BL: 0-0.5 Smoking: No Genetic/Systemic: No	Oral hygiene motivation/ instructions If necessary, regular dental prophylaxis	Annual dental check-up
Moderate Risk	BOP: 10-25% PPD: 5-8 TL: 5-8 BL: >0.5-1.0 Smoking: 10-19 cig/day Genetic/Systemic: No	Oral hygiene motivation/instructions Determining periodontal disease risk factors	Dental Check-up every 6-12 months
High Risk	BOP: >25% PPD>8 TL: >8 BL: >1.0 Smoking: >19 cig/day Genetic/Systemic: Yes	Oral hygiene motivation Determining and eliminating periodontal disease risk factors Consultation with periodontist	Dental Examination Every 3-6 months

*BOP = Bleeding on probing (% of sites); PPD refer to number of sites with periodontal pocket depth >5mm; TL = Tooth loss; BL = bone loss/age

Appendix 5

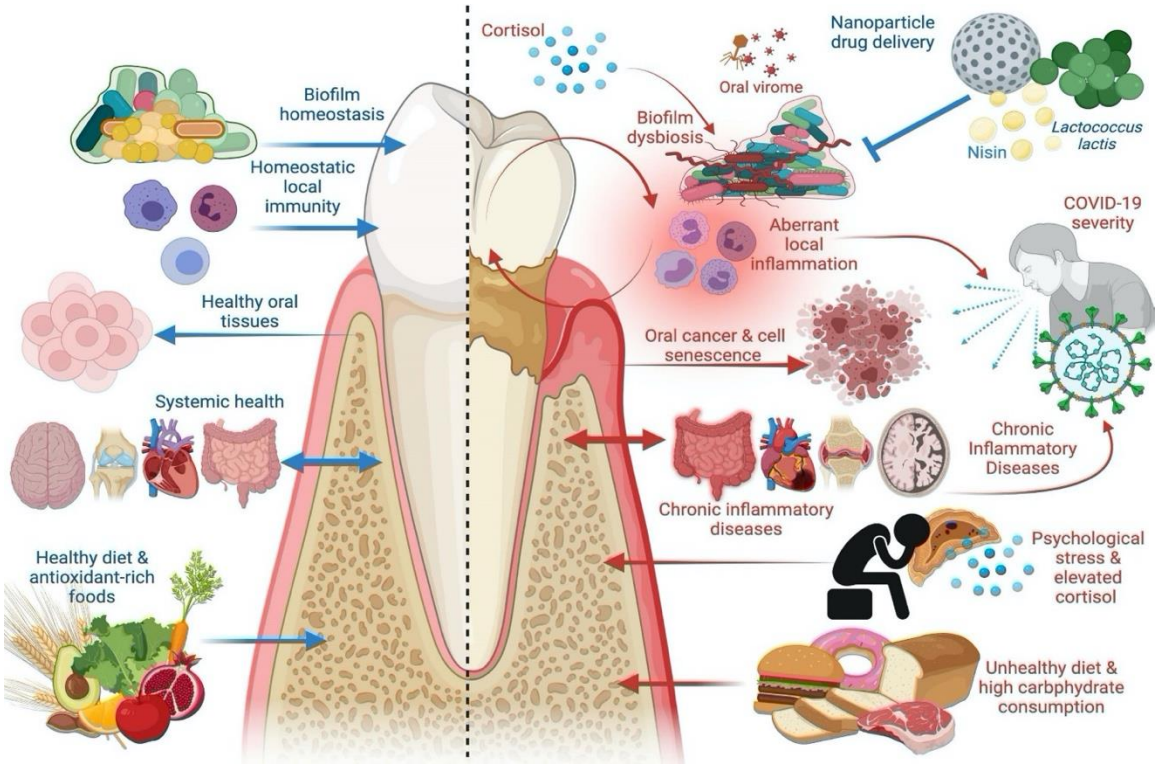


Figure 5. Multifactorial aetiology and risk factors of Periodontitis and systemic health. Left panel: factors that promote periodontal health. Right panel: factors that promote periodontal disease[12] Level III

Appendix 6

Table 4. Adjunctive antibiotic of periodontal therapy

Antibiotic	Dosage*	Duration
Metronidazole + Amoxicillin	Metronidazole = 400 mg tds + Amoxicillin = 500 mg tds	7 days
Metronidazole	400 mg q8h	7 days
Clindamycin	300 mg q6h	7 days
Azithromycin	500 mg daily	3 days

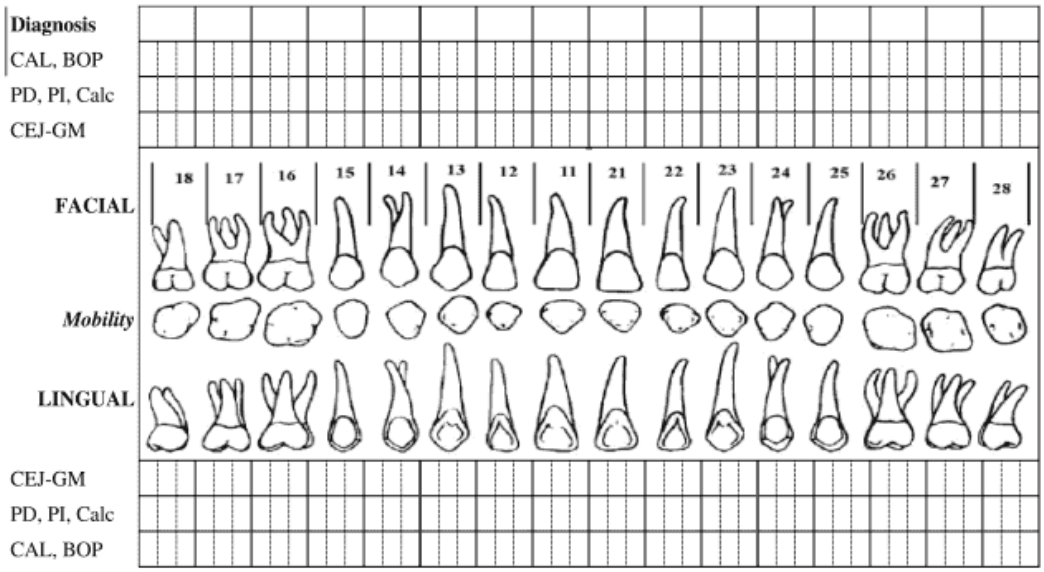
*Adult dosage with normal renal function

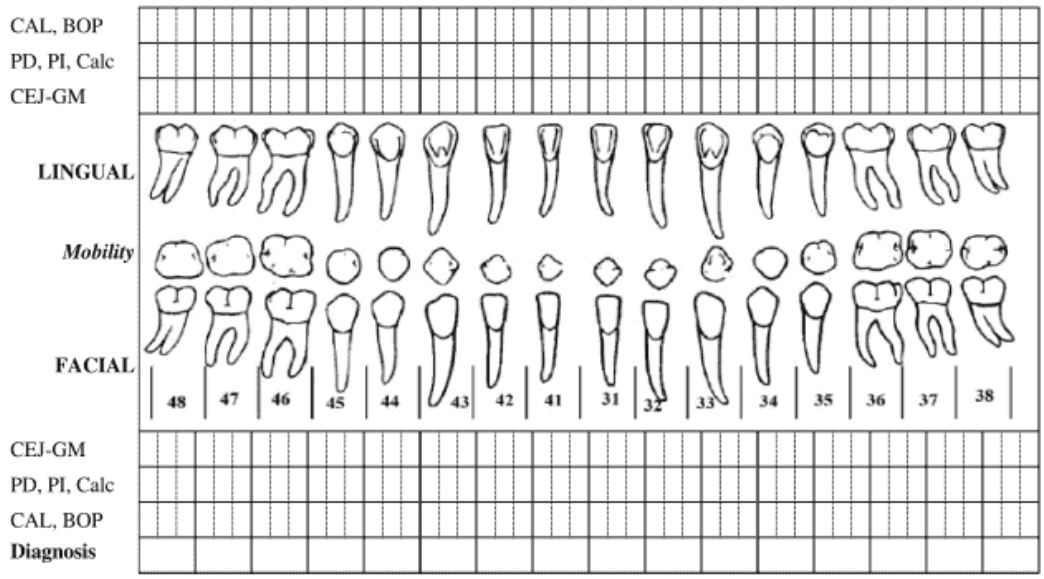
Appendix 7

PERIODONTAL CHART

PATIENT NAME: _____ **FILE NO.:** _____ **DATE:** _____

☐ Pre-treatment ☐ Re-evaluation ☐ Recall maintenance





GM- Gingival Margin. **CAL-** Clinical Attachment Loss. **CEJ-** Cementoenamel Junction. **PD-** Probing Depth
PI- Plaque, if presents put *. **Calc-** Calculus, if presents put *. **BOP-** Bleeding on probing, if presents put red

Plaque Index ☐ **Bleeding Index** ☐

Periodontal Diagnosis:

Supervisor's Signature

Appendix 8

កិច្ចព្រមព្រៀងក្នុងការព្យាបាលធ្មេញ

១.នាងខ្ញុំ/ ខ្ញុំបាទទទួលការពន្យល់យ៉ាងក្បោះក្បាយអំពីដំណើរការនៃការព្យាបាលធ្មេញ ពីផលប្រយោជន៍ និងផលប៉ះពាល់។

២.នាងខ្ញុំ/ខ្ញុំបាទប្រាប់ពីបញ្ហាសុខភាពរបស់ខ្ញុំគ្រប់យ៉ាងដែលខ្ញុំបានដឹងរួមមាន: ជំងឺ ឈាម ការហូរឈាមមិនធម្មតា ប្រតិកម្ម និង បញ្ហាផ្សេងៗដែលទាក់ទងនិងបញ្ហាសុខភាពរបស់ខ្ញុំ។ ខ្ញុំមានទំនុកចិត្តទៅលើទន្តបណ្ឌិតក្នុងព្យាបាលធ្មេញ។

៣. នាងខ្ញុំ/ខ្ញុំបាទទទួលការពន្យល់ថា ការពិសាបារី ការពិសាគ្រឿងស្រវឹង ការធ្វើការហួសកំលាំង អាចមានផលប៉ះពាល់ដល់គុណភាពនៃការព្យាបាល។

៤.នាងខ្ញុំ/ខ្ញុំបាទអនុញ្ញាតឲ្យគេថតកាំរស្មី ការធ្វើរោគវិនិច្ឆ័យនៃ X-Ray ការយកពុម្ពក្នុងមាត់ និងការកត់ត្រាទុកនៃរោគវិនិច្ឆ័យ និងការធ្វើការព្យាបាល។ ខ្ញុំយល់ថា ទិន្នន័យទាំងនោះអាចបង្ហាញនៅលើ ទស្សនាវដ្តីឬប្រព័ន្ធផ្សព្វផ្សាយផ្សេងទៀតក្នុងគោល បំណងដើម្បីឲ្យបានយល់ដឹងបានច្បាស់ក្នុងខណៈដែលការពិតអត្តសញ្ញាណរបស់ខ្ញុំមិនត្រូវបានបង្ហាញ។

៥.នាងខ្ញុំ/ខ្ញុំបាទនឹងធ្វើតាមការណែនាំរបស់ ទន្តបណ្ឌិតក្នុងអំឡុងពេលទទួលការព្យាបាលហើយនឹងមកតាមការណាត់ពេលដែលទន្តបណ្ឌិតតម្រូវឲ្យមកជួប។

៦.នាងខ្ញុំ/ខ្ញុំបាទនឹងមិនស្នើសុំទៅលើការទទួលខុសត្រូវ ដែលបានកើតឡើងក្នុងអំឡុងពេលទទួលការព្យាបាលដូចបានរៀបរាប់ខាងលើ។

៧.នាងខ្ញុំ/ខ្ញុំបាទយល់ព្រមតាមតម្លៃព្យាបាលរបស់ទន្តបណ្ឌិត។

ទន្តបណ្ឌិត	សាក្សី	អ្នកជំងឺ
ហត្ថលេខា	ហត្ថលេខា	ហត្ថលេខាឬស្នាមមេដៃ

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Chapter 4:

Endodontics

1. Management of Acute Apical Abscess
2. Management of Symptomatic Irreversible Pulpitis

MANGEMENT OF ACUTE APICAL ABSCESS

Lim Ratanak, Khung Rathvisal, Sreng Thea, Nou Nora, Chhong Vantha

I. INTRODUCTION & CASE DEFINITION

Acute apical abscess (known as acute periapical/periradicular abscess) is one of the most common cause of dental emergency. It is an inflammatory reaction to pulpal infection and necrosis characterized by rapid onset, spontaneous pain, extreme tenderness of the tooth to pressure, pus formation and swelling of associated tissues. [1, Level I] This apical condition is mostly formed when bacterial infection goes into the periapical tissues and the acute inflammatory response is then induced followed by pus formation.

II. ETIOLOGY

- Caries causes pulpal necrosis [2, Level I]
- Traumatic/chemical involvement of the pulp
- Mechanical irritation

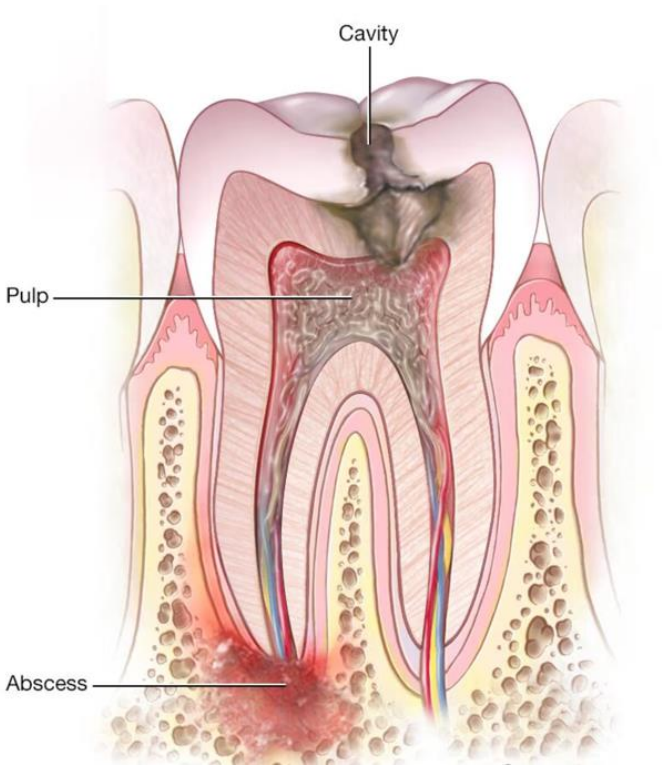


Figure 1: apical abscess

III. DIAGNOSIS

1. **History taking**
    - Chief complaint
    - Pain (when, where, how long)
    - Previous dental treatment
    - Trauma
    - Smoking
2. **Clinical examination**
    - Extra-oral examination
        - Facial swelling and asymmetry
        - Lymphadenopathy
    - Intra-oral examination
        - Deep caries/secondary caries underneath restorations/defective restoration
        - Exposed pulp chamber
        - Filling/restoration
    - Signs and symptoms
        - Pain when chewing or biting but also spontaneous pain
        - Malaise, fever, or swollen lymph nodes
        - Sometimes difficult to swallow
        - Rapid progression of swelling (surrounding tissues and/or face)
        - Presence of pus
        - Systemic manifestations of an infective process (high temperature, malaise, etc)
        - The tooth is often elevated in its socket and interferes in occlusion.
3. **Investigation**
    - Thermal tests
    - Negative response to sensitivity test and electric pulp tester
    - Percussion and palpation
    - Very tender to palpation and percussion
    - Periodontal assessment
    - Deep pocket depth can be detected in some cases
    - Tooth mobility may be noticed.
    - Radiographic finding

- Thickening of periodontal ligament space (initial stage)
- Apical radiolucency

4. Differential diagnosis

- Periodontal abscess
- Vertical root fracture

Key message 1

Characteristics of periodontal abscess

- **Positive response to sensitivity test**
- **Presence or absence of the dental caries**
- **Deep periodontal pocket defects**
- **Lateral radiolucency**

Key message 2

Characteristics of vertical root fracture

- **Pain while biting on specific cusp/point**
- **Crack line when examining with transillumination or blue dye**
- **Deep narrow (isolated) pocket depth**
- **J-shaped lesion**

IV. MANAGEMENT

1. Treatment

- Antibiotics (see the antibiotic use page…)
  - If adequate drainage cannot be established through root canal, incision and drainage, or extraction, antibiotics are commonly prescribed to prevent systemic complications. [2, Level I]
  - The use of antibiotics alone, without properly addressing the source of the endodontic infection, is not appropriate treatment.
  - Analgesics may be prescribed for pain control.
- Incision for drainage
  - In some cases, drainage can be obtained through the root canal, but when swelling is present, incision for drainage should also be performed. [3, Level I]

- Root canal treatment (restorable)
- Extraction (non-restorable)

2. **Clinical procedure for root canal treatment** (similar to endodontic treatment of SIP)
   - Canal shaping and cleaning
   - A minimum master apical file size of a #30 K file allowed penetration of irrigants to the apex. [4, Level I]
   - During root canal preparation, apical extrusion should be prevented because it can cause interappointment flare-up and postoperative pain. [5, Level I]
   - The root canal system should be finally irrigated with NaOCl after EDTA solution.

Recommendation 1
Rotary instruments used in a crown-down technique seem to produce less extrusion than stainless steel hand instruments used in step-back technique. **Grade A**

   - Intracanal medicament
   - Calcium hydroxide should be dressed in canals at least 1 week. [6, Level I]

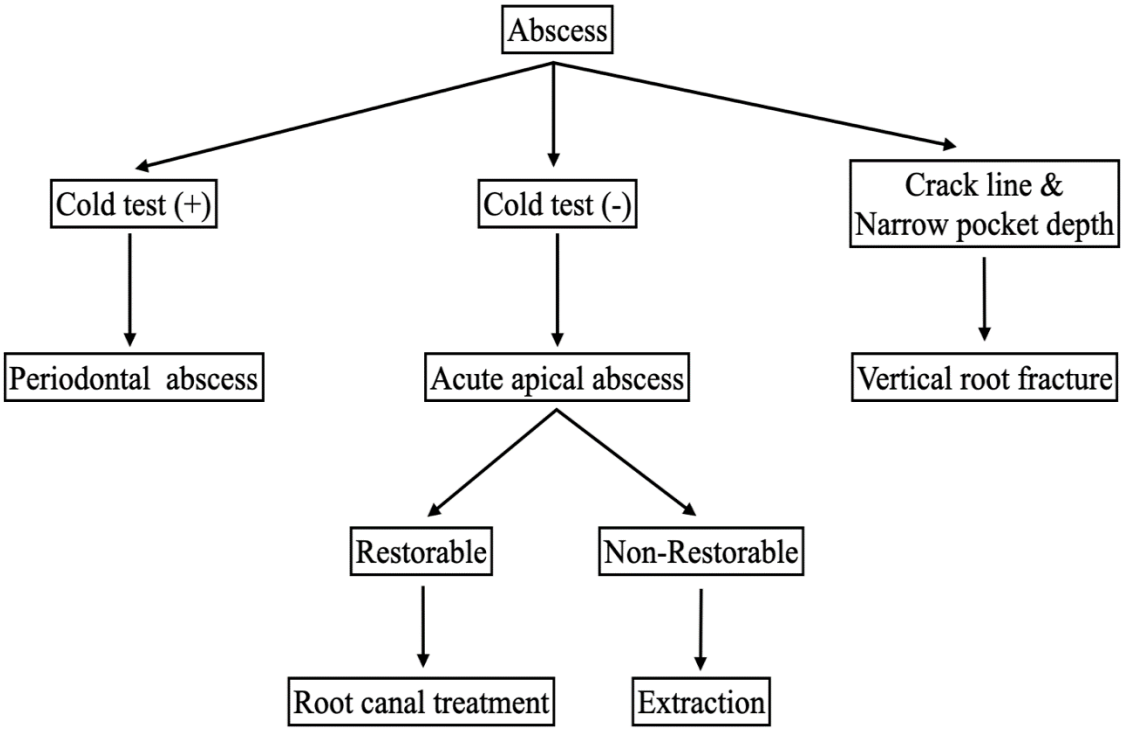
Recommendation 2
Leaving the tooth open is not recommended. After complete canal disinfection and debridement, closing root canal system does not cause severe pain or swelling. **Grade A**

Recommendation 3
Multiple-visit endodontic should be done in case of acute apical abscess. **Grade A**

3. **Complication**

If left untreated, it can spread to the jaw and to other areas of the head and neck. In some cases, infection can even get into your blood and cause sepsis and a life-threatening condition.

V. AGORITHM



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MANAGEMENT OF SYMPTOMATIC IRREVERSIBLE PULPITIS

Lim Ratanak, Khung Rathvisal, Sreng Thea, Nou Nora, Chhong Vantha

I. INTRODUCTION

The symptomatic irreversible pulpitis (SIP) is the most prevalent condition affecting approximately 45% of teeth diagnosed with pulp pathology of patients seeking dental treatment.[1, Level II-2] It is often considered the most intolerable pain.

II. CASE DEFINITION

SIP is a severe inflammatory condition of pulp that will not resolve even if the cause is removed. Its characteristics may include lingering, spontaneous and referred pain.[2, Level I] It is often a sequel to and a progression from reversible pulpitis. The pulp slowly or rapidly becomes necrotic.

III. ETIOLOGY

- Dental caries (most common)
- Chemical, thermal, mechanical injuries of pulp
- Dental trauma
- Crack
- Untreated reversible pulpitis
-

IV. DIAGNOSIS

1.1. History taking

- Chief complaint
- Where is the pain located? Can you point to the offending tooth?
- When does it start? (provoked/spontaneous)
- How long does it last? (intermittent/continuous/lingering)
- How intense is it? (dull/sharp/electrical)
- Does anything make it worse? (cold/heat/biting)

1.2. Clinical examination

- Extra-oral examination
  - No abnormality detected
- Intra-oral examination
  - Deep caries involving pulp
  - Secondary caries underneath restorations/defective restoration
  - Crack line

Figure 1: Dental caries on upper first molar

- Signs and symptoms
  - Spontaneous and sharp pain
  - Pain to cold and heat
  - Lingering pain from several minutes to several hours (even after removing stimuli)
  - Referred pain
  - Pain when lying down or bending over (postural changes)
  - Patient usually stays awake at night due to severe pain
  - Analgesics are typically ineffective

1.3. Investigation

- Thermal tests
  - Cold testing results in a heightened and lingering response

- Percussion and palpation
  - In earlier stage, no tenderness to percussion and palpation
  - But sometimes if the inflammation extends to periapical area, the tooth may respond to percussion and palpation.
- Periodontal assessment
  - In case of healthy periodontal status, pocket depth and mobility are within normal limit.
  - In case of periodontal disease, pocket depth and mobility depend on the periodontal condition.
- Radiographic finding
  - Depth and extent of caries or restoration close to or encroaching the pulp chamber/horn
  - Normal periodontal ligament (PDL) space and lamina dura, but with advanced irreversible pulpitis, a thickening of the periodontal ligament may become evident on the radiograph

Figure 2: Bitewing radiograph shows lower first molar with dental caries extending to pulp chamber.

Figure 3: Periapical radiograph shows recurrent caries underneath restoration close to the pulp horn.

1.4. Differential diagnosis

- Reversible pulpitis
  - No history of spontaneous pain
  - Pain occurs with stimuli, but the pain will resolve after a few seconds once the stimulus has been removed.
  - No response/tenderness to percussion/palpation
  - Normal PDL space on radiograph

VII. MANAGEMENT

1. Treatment

- Restorable tooth
  - Pulpectomy
  - If time is limited, emergency pulpotomy should be done to relieve the pain.[3,4, Level I] However, pulpectomy will still need to be carried out at the next visit.
- Non-restorable tooth
  - Extraction

2. Clinical procedure for pulpectomy

- Local anesthesia
- Complete removal of the caries and/or defect restoration
  - Restorability of the tooth is then reassessed, given close attention to any crack lines which might be detectable only after removal of the defect restoration.

Key message 1

Crown lengthening or orthodontic extrusion might be considered to make the tooth restorable.

Recommendation

Rubber dam placement is considered as standard of care in endodontic treatment because it provides many advantages such as control of cross-infection, prevention of instrument swallowing, and improving treatment efficiency.

Grade A

- Access cavity
  - Remove entire roof of the pulp chamber
  - Obtain straight line access

Figure 4: Access cavity on lower molar

- Working length

- Use electronic apex locator then confirm with x-ray which should reveal the tip of the file located within 0.5-2mm short of the radiographic apex.[5,6, Level I]

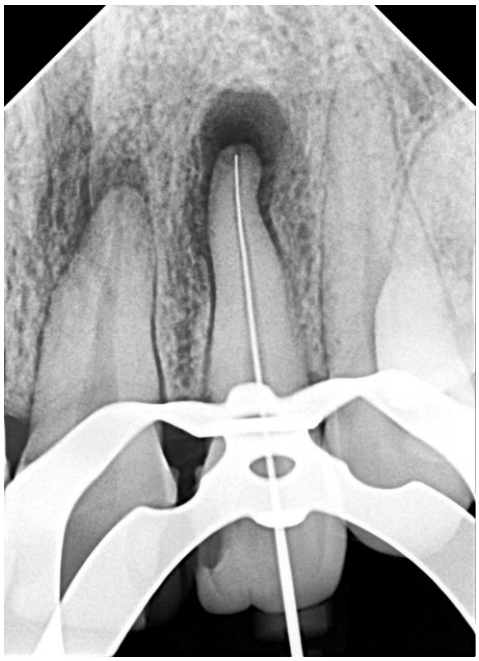


Figure 5: Take X-ray to confirm working length on upper lateral incisor

- Canal shaping and cleaning
- In large and straight canal, pulp extirpation can be performed with barbed broach.
- In curved canals, stainless steel file should be precurved or bended before inserting into canals.
- Continuously tapering from the canal orifice to the apex using step back or preferably crown down technique with rotary instruments
- Follow the original anatomy and curvature of the canals and avoid procedural errors (ledge, zipping, perforation, file separation)
- Reduce apical extrusion of debris during instrumention
- Create sufficient space for irrigants and intracanal medicaments

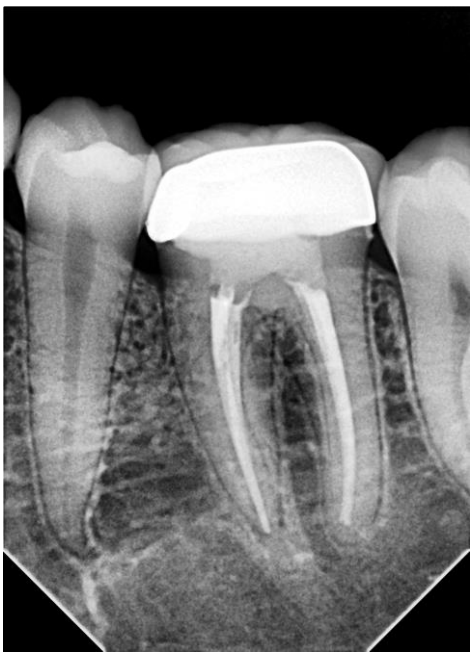


Figure 6: Canals should be tapered and no procedural errors

- Between each file, the canal is irrigated with sodium hypochlorite (1-5.25%) to flush out debris and lubricate the canal using 30G double side-vented needle by placing its tip 1-2mm short of the working length without binding any dentinal wall.
- After shaping, EDTA 17% solution should be used to remove smear layer.
- To be more effective, irrigants should be activated in the root canal.

Figure 7: Irrigant in the pulp chamber after activation

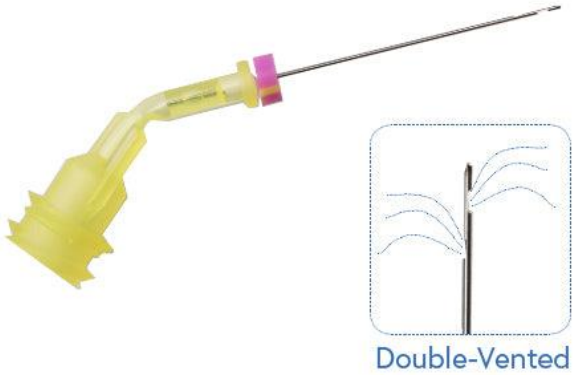


Figure 8: Double side-vented irrigation needle

- Intracanal medicament
- In simple cases, single visit endodontics can be performed but if there are any complexities of the canal anatomy, uncontrolled bleeding or limited time, the canal should be dressed with calcium hydroxide interappointmentally.
- Obturation
- The canal is dried with sterile paper point.
- The canal is finally filled using either lateral condensation or warm vertical condensation with gutta-percha and non-toxic sealer.
- Caution should be exercised to avoid apical extrusion of the obturating materials.
- X-ray should be taken to make sure that there is no apical extrusion.

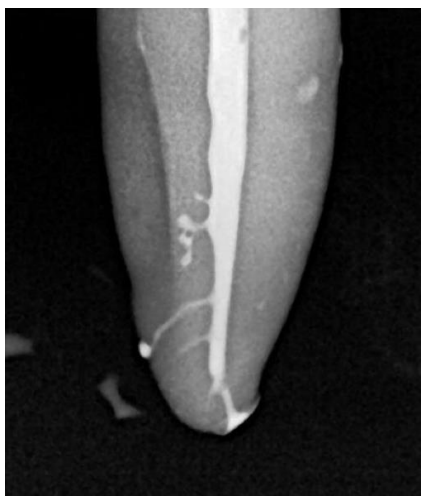


Figure 9: Anatomical complexities are filled with flowable sealer

- Temporary filling
  - The temporary filling should be at least 3 mm and preferably 4-5 mm thick.
  - If we have enough time for permanent restoration, the temporary filling is not needed.

Key message 2

Usually, the patient does not experience pain after pulpectomy but he/she can take analgesics as needed.

Key message 3

Clinical and radiographic follow-up examinations should take place 6 to 12 months.

3. Complication

- If left untreated, the tooth will become necrotic and periapical infection will occur.

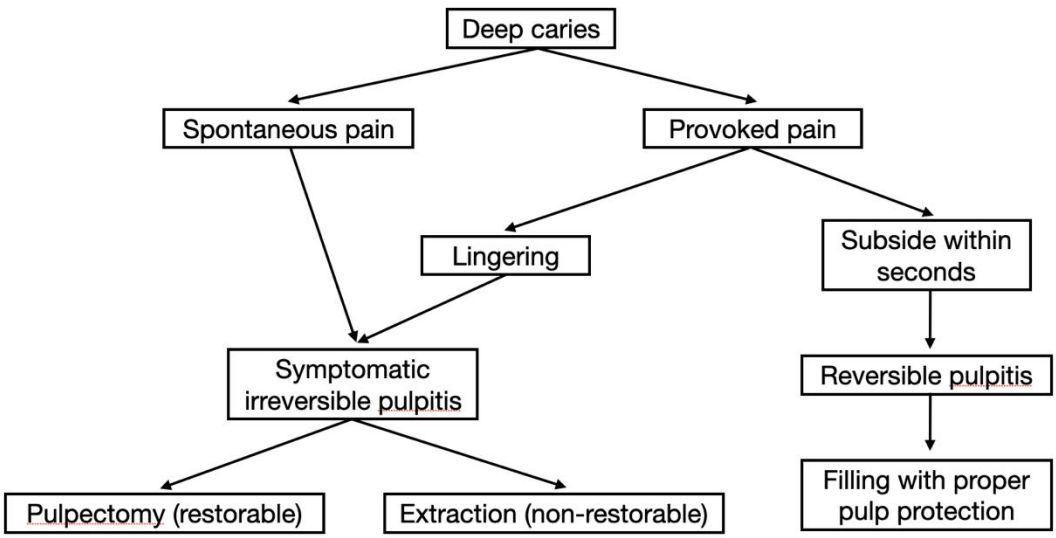
Key message 4

Antibiotics are not needed in case of SIP.[7, Level I]

Key message 5

The use of devitalizing agents is no longer indicated and recommended.[8, Level I]

VIII. AGORITHM



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Chapter5:

Pediatric Dentistry

1. Management of Early Childhood Caries (ECC)
2. Management of Traumatic dental injuries:
   Avulsion of permanent and primary teeth
3. Molar Incisor Hypomineralization

MANAGEMENT OF EARLY CHILDHOOD CARIES (ECC)

CHHE Phearom, DURWARD Callum, YOS Chantho, SIENG Chanthyda

I. INTRODUCTION

Early childhood caries (ECC) is a worldwide problem that is prevalent in low and middle-income countries, where exposure to sugars has increased following the nutrition transition to a high sugar diet[1, Level III]. ECC does not only affect children's oral health, but also their general health and quality of life. Oral problems may include pain, infections, poor appearance, and orthodontic problems. There may also be problems with eating and speaking, and children with ECC have an increased risk for caries development in the permanent dentition [2, Level II-2] .

In Southeast Asian countries, there was a wide range of caries prevalence (25–95%) and caries experience (dmft score = 0.9–9.0) in 5- to 6-year-old children [3, Level II-2]. According to the National Oral Health Survey (NOHS) Cambodia conducted in 2011, the prevalence rate of dental caries among 6-year-olds was 93.1% and the mean dmft score was 8.9 [4, Level II-2].

II. DEFINITION

Early childhood caries (ECC) is defined as the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in the primary teeth of a child younger than six years old. Severe ECC (S-ECC) is defined as is any sign of smooth-surface caries in a child younger than three years of age, and from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of greater than or equal to four (age 3), greater than or equal to five (age 4), or greater than or equal to six (age 5) (Fig. 1, 2, 3) [5, Level III].

Fig. 1, 2, 3 Stages of early childhood caries

Early Moderate Advanced

III. ETIOLOGY

The etiology of ECC is multifactorial and has been frequently associated with [6, Level III]:

a. Cariogenic microorganisms:

Early childhood caries (ECC) is mainly caused by Streptococcus mutans and Streptococcus sobrinus, bacteria that break down sugars like sucrose and produce acid. This acid lowers the pH in the mouth, leading to enamel demineralization, cavity formation, and eventually damage to the dentine and pulp if untreated.

b. Direct Transmission of Infection:

Vertical transmission of Streptococcus mutans from the mother to the child may occur through infected saliva e.g., when kissing or sharing food and utensils.

c. Saliva:

Reduced saliva production at night allows acid from bacteria to build up, leading to tooth demineralization, especially in children with poor oral hygiene or those fed with bottles or breastfeeding during the night.

d. Improper Dietary and Feeding Practices:

Children who consume sugary foods or rice that has been pre-chewed by the mother have been found to have higher levels of ECC. Bottle- and breast-feeding at night after the age of 24 months increases the risk of developing early childhood caries.

e. Sugary Diets:

Early childhood caries is more frequent in children who regularly consume sweet foods and drinks.

f. Developmental Enamel Defects:

Developmental enamel defects like hypoplasia and hypomineralization increase the risk of early childhood caries (ECC) as Streptococcus mutans easily colonizes the rough enamel surfaces.

g. Systemic Diseases and Medications:

Children with juvenile diabetes, special needs, cancer undergoing radiotherapy, or chronic illnesses are more prone to early childhood caries (ECC) due to poor oral hygiene, reduced saliva flow, and frequent use of sugar-containing medications.

h. Socioeconomic and Ethnic Factors:

Early childhood caries (ECC) is more common in children from low-income families due to factors like malnutrition, poor oral hygiene, high sugar intake, limited access to dental care, and lack of fluoride exposure.

IV. DIAGNOSIS

Diagnosis of early childhood caries is both by visual and clinical examination of children who are at risk.

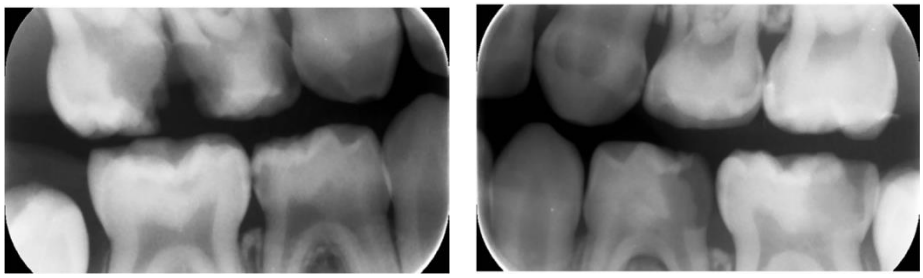
4.1 Visual and clinical examination [7, Level III]

- Reliable diagnosis and recording of carious lesions require clean and dry teeth.
- Early ECC appears as opaque white spots, typically starting at the cervical third of upper anterior teeth, progressing to involve other primary teeth and developing into yellowish-brown lesions.
- In severe ECC, lesions may expose pulp tissue and cause crown breakdown, leaving retained roots.
- A thorough clinical examination includes visual inspection under good lighting, cleaning plaque deposits, and using a plane mouth mirror and bitewing radiographs.
- Probing is discouraged for pits and fissures but may assess caries activity in exposed dentine.

4.2 Radiographic examination [8, Level II-2]

The broad contact points of the primary dentition make diagnosis of approximal caries difficult. Therefore, bitewing radiographs (Fig. 4, 5) are an important adjunct in detecting proximal caries for children aged four and above. If a child is uncooperative for bitewings, a bi-maxillary oblique lateral view may be obtained.

Fig. 4, 5 Bitewing radiographs



Recommendation 1
• **Care givers and health professionals should regularly lift the lip of the child to look for early signs of decay on the surfaces of upper teeth.** • **Dental examination should be carried out by visual inspection with the aid of a plane mouth mirror and PBW radiographs to identify caries.** **Grade A**

V. MANAGEMENT

5.1 Preventive measures [9, Level III]

- Limit intake of sugary foods and drinks. Drink mainly water and plain milk.
- Avoiding night-time bottle feeding and do not put any sweet drinks into the bottle. Stop the bottle habit by age 1.
- Avoid nocturnal or on-demand breastfeeding beyond 24 months.
- Provide optimal exposure to fluorides, including drinking fluoridated water (if available), and regular topical applications of 5% NaF varnish in at-risk children.
- Parent/caregiver to brush child's teeth with the age-appropriate (*) amount of fluoridated toothpaste, which contains 1,000–1,500 ppm fluoride, twice a day, starting soon after the first teeth erupt.
- Establish a dental home for the young child and have regular dental visits starting from the age of one year.
- Applying pit and fissure sealants to susceptible molars.

* For age 1-3 years use smear; age 3-6 use pea size.

*** How to apply Fluoride Varnish (5% NaF)**: First clean and dry the child's teeth. Use

a small applicator or micro-brush to apply a thin layer of varnish to the enamel, especially on the biting surfaces and around the gumline. Avoid eating, drinking, or brushing the teeth for at least 30 minutes after application to allow the varnish to fully set and maximize its effectiveness. Reapply every 3-6 months for children at high risk of ECC.

5.2 Treatment interventions [10, Level III]

- Apply SDF to carious lesions and susceptive fissures
- Restorations with Glass ionomer cement (GIC), RMGIC or Composite
- Atraumatic Restorative Treatment (ART)
- Pre-formed stainless-steel crown (SSC) – conventional or Hall technique
- Pulp Therapy (pulpectomy, pulpotomy)
- Extraction followed by space maintainers.

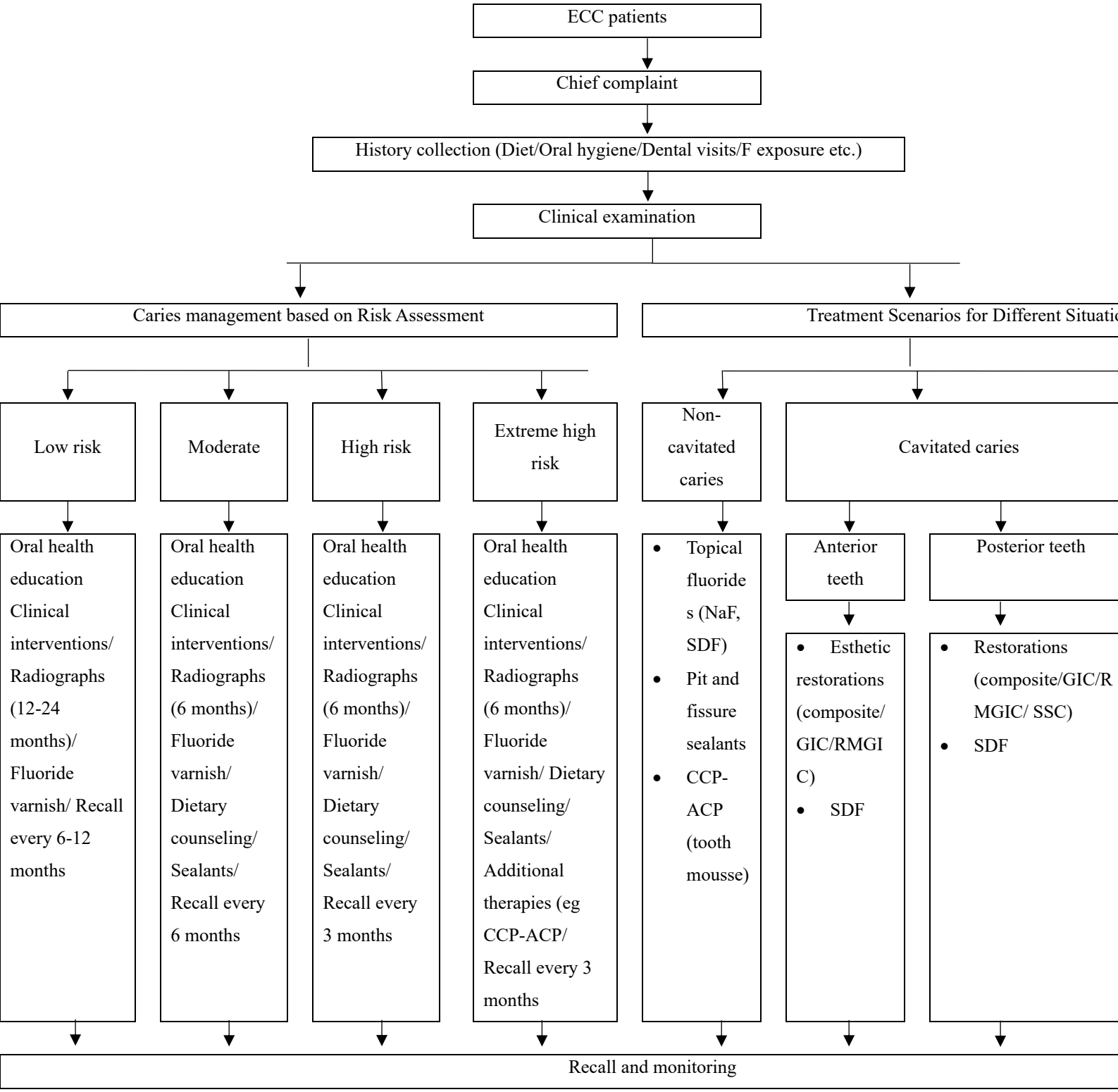
*** How to apply Silver Diamine Fluoride (SDF 30% or 38%)**: First clean and dry the affected tooth. Use a micro-brush to carefully apply a small amount of SDF to the cavity or decayed areas. Wait for 1 minutes to allow it to absorb and turn black before wiping off any excess. Avoid eating or drinking for at least 30 minutes to ensure optimal absorption. Reapply every 6-12 months depending on the severity of the decay and the child's risk of further caries.

5.3 Recall and follow-up

Children with ECC must be reviewed to detect any changes. All children should be seen once a year – some need more regular visits based on their caries risk.

Recommendation 1
Children with ECC must be recalled according to intervals based on the outcome of their caries risk status. **Grade A**

VI. ALGORITHM FOR MANAGEMENT OF ECC



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THE MANAGEMENT OF TRAUMATIC DENTAL INJURIES: AVULSION OF PERMANENT AND PRIMARY TEETH

CHHE Phearom, DURWARD Callum, SIENG Chanthyda, PING Bushara, KOR Hok Sim, Rith Boriroth, Ouk Darin

1. INTRODUCTION

Traumatic dental injuries (TDIs) are common in children and adolescents, with avulsion being one of the most severe injuries. Avulsion results in damage to the periodontal ligament, pulp, alveolar bone, and surrounding soft tissues. Immediate and appropriate management is critical to ensure a favourable prognosis.

In permanent teeth, replantation is the gold standard, aimed at preserving function and aesthetics. For primary teeth, replantation is generally avoided to protect the developing permanent tooth germ. The prognosis of avulsed teeth depends on factors such as the time since avulsion, storage conditions of the tooth, and the intervention provided.

Avulsion injuries account for 0.5%–16% of all TDIs, with permanent teeth more commonly affected in older children and adolescents. Primary tooth avulsion is frequent in children aged 2–4 years due to falls, while avulsion in permanent teeth peaks between 7–9 years. Maxillary central incisors are the most commonly affected teeth due to their anterior position and lack of protection [1, 2, Level III].

2. DEFINITION [3, Level III]

Tooth avulsion is the complete displacement of a tooth from its alveolar socket due to trauma (Fig. 1a,b).

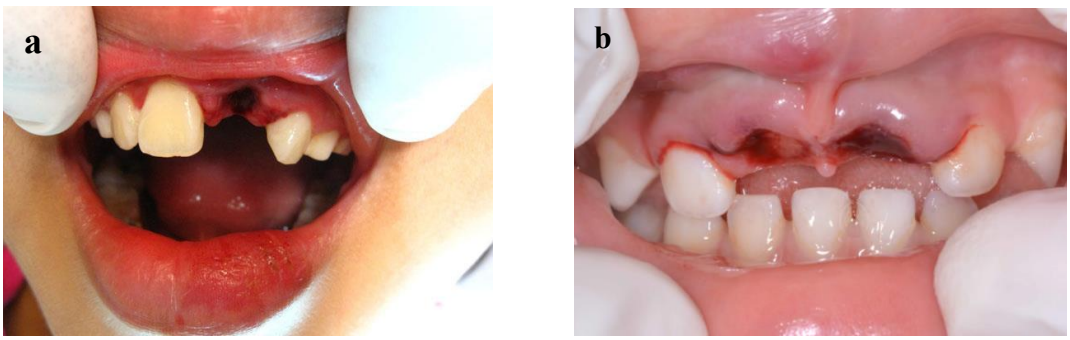
1) Permanent Teeth

- Replantation is the standard treatment, aiming to restore function and aesthetics.
- Prognosis depends on immediate care, including proper storage and handling of the avulsed tooth.

2) Primary Teeth

- Avulsion is more common in primary teeth due to their shallower roots and less developed supporting structures.
- Replantation is contraindicated to avoid damage to the underlying permanent tooth germ.

Fig. 1 Avulsion of permanent maxillary central incisor #21 (a). Avulsion of primary maxillary central incisor #51, #61 (b).



3. ETIOLOGY

The more common risks for traumatic dental injuries are [4, Level III]:

1. Trauma

- Falls
- Fights
- Sports injuries
- Motor vehicle or bicycle accidents
- Assaults

2. Predisposing Factors

- Increased overjet and inadequate lip coverage.
- Participation in high-risk activities without appropriate protective equipment.

4. DIAGNOSIS

1. History taking

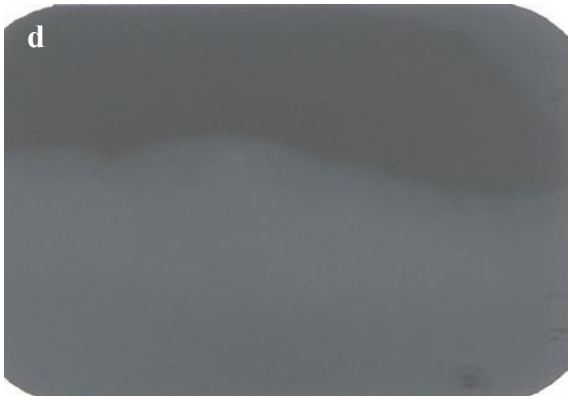
- **Mechanism of Injury**: Determine how the trauma occurred (e.g., fall, sports, accident). whether loss of consciousness or not any dizziness, amnesia, anti-tetanus vaccination status.
- **Time Since**: Treatment urgency since injury influences the prognosis.
- **Associated Symptoms**: Bleeding, pain, numbness, difficulty in closing the mouth, or changes in tooth position.
- **Past Dental History**: Pre-existing conditions like orthodontic treatment, previous trauma, or dental procedures.

Key message 1
If any vomiting, headache, unconsciousness, or drowsiness are reported, this should be further investigated at the hospital.

2. Clinical examination

- **Extraoral Examination**: First examine the face, neck, lips, swelling or bruising lacerations. Next, examine the bony fractures such as facial asymmetry, an inability to close the mouth, or a deviation in mouth opening.
- **Intraoral Examination**:
  - Check for tooth mobility, fractures, displacements, or avulsions. If tooth fracture is present, assess each fractured tooth and record whether it sustained an uncomplicated or complicated fracture that is limited to the crown or involves the pulp or root.
  - Carefully remove the remove adherent blood clot and debris.
  - Inspect soft tissues for lacerations, contusions, or hematomas. If soft tissue wounds are present, the possibility of fragments embedded within the tissues must be excluded by radiograph (Fig. 2c,d).
  - Palpate the alveolar bone for fractures or tenderness.
  - Evaluate occlusion for malalignment or changes in the bite.

Fig. 2c,d Demonstration of the technique for taking a soft tissue radiograph of the lower lip (c). Soft tissue radiograph following fracture of maxillary central incisors. There is no evidence of tooth fragment in the lip (d).



3. Investigation

- **Periapical X-rays**: Assess tooth root fractures, root position, and checking for baseline.
- **Panoramic X-ray**: Evaluate for fractures of the jaws and alveolar bone.
- **CBCT (Cone Beam CT)**: For detailed three-dimensional assessment of complex fractures.
- **Sensibility Testing**: determine the condition of the pulp (cold test and electric pulp test).

Note: For the child who is unable to tolerate a radiographic examination even with a caregiver's help, the dentist should consider the advanced behavior management options for the child. It may be best to triage and stabilize the patient for a limited time so that the child may have a thorough evaluation and high-quality treatment provided using sedation or general anesthesia.

Recommendation 1
Immediate referral to an oral and maxillofacial surgeon for moderate to severe maxillofacial injuries. **Grade B**

5. MANAGEMENT

5.1. At the site of incident [5, Level III]

- **Primary tooth**
  - Do not replant the tooth
  - Get the patient to bite on gauze or a clean cloth to control bleeding
  - If dirty, gently rinse the mouth with normal saline or clean water
  - Store the tooth in a container or appropriate medium for identification purpose
  - Go to the nearest dental clinic or pediatric dentist
- **Permanent tooth**

  The followings should be performed:
  - Hold the tooth by the crown, avoiding contact with the root (this is not applicable for primary teeth since replantation is not recommended)
  - Inspect the root to ensure it's clean.
  - If dirty, gently rinse with normal saline or clean water for 10 seconds, without scrubbing the root.
  - Gently place the tooth into its socket without traumatizing the tooth and the adjacent structures.
  - Get the patient to bite on gauze or a clean cloth to keep the tooth in place.
  - Go to the nearest dental clinic as soon as possible.

***Note*:** If immediate replantation is not possible, store the avulsed permanent front tooth in an appropriate medium (avoid dehydration of the root surface) and transport it to the nearest dental clinic as soon as possible. The options of storage medium are shown below (Table 1).

Table 1: Options of storage medium

STORAGE MEDIUM	PREPARATION	MAXIMUM STORAGE
Milk	• **Recommend:** Pasteurized or fresh cow's milk, cold, low-fat, non-flavoured milk. • **NOT Recommend:** condensed milk or powdered milk, soy milk, flavoured milk.	2-3 h
Normal saline	Physiological saline contains 0.9% sodium chloride	1h
Saliva	Get the patient to spit into a clean container	30 mn
Coconut water	Fresh tender coconut water	45 mn
Egg	Egg white only	24 h

Key message 2
1. For an avulsed permanent anterior tooth, the best storage medium is the tooth socket itself. 2. Timing of treatment is critical, especially for avulsed teeth, which have a better prognosis if reimplanted within an hour of injury.

5.2 At the dental clinic [4, 5, Level III]

a. Primary tooth

- **Perform** a thorough clinical examination to assess the socket and surrounding tissues for any additional injuries, such as fractures to the alveolar bone or soft tissues.
- **Check** for any injuries to adjacent teeth and assess if any tooth fragments remain in the socket.

- No Replantation: Replantation of primary teeth is not recommended due to the risk of damaging the developing permanent tooth germ.
- Clean the socket gently with saline or a similar non-irritating solution. In some cases, a soft dressing may be placed to protect the socket and aid in healing.
- Monitor the healing of the socket for any signs of infection or delayed healing. The child may need follow-up visits to ensure the socket is healing properly.
- Consider prescribing antibiotics if there is a risk of infection, particularly if the injury involves significant soft tissue damage or contamination.
- Arrange follow-up appointments to assess the healing process and to monitor the eruption of the underlying permanent tooth.
- Inform the parents about possible complications and the need for follow-up care. Educate them on the potential signs of issues in the underlying permanent tooth, including abnormal eruption or tooth discoloration.

b. Permanent tooth

5.2.1. Avulsed permanent teeth with a closed apex: the tooth has been replanted at the site of injury or before the patient's arrival at the dental clinic

- Clean the injured area with clean water, saline, or chlorhexidine.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Leave the tooth/teeth in place (except where the tooth is malpositioned; the malpositioning needs to be corrected using slight digital pressure).
- Administer local anesthesia, if necessary.
- If the tooth or teeth were replanted in the wrong socket or rotated, consider repositioning the tooth/teeth into the proper location up to 48 hours after the traumatic incident.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016” or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Suture gingival lacerations, if present.
- Initiate root canal treatment within 2 weeks after replantation.
- Administer systemic antibiotics.
- Check tetanus status.

- Provide post-operative instructions.
- Follow up.

5.2.2 Avulsed permanent teeth with a closed apex: the tooth has been kept in a physiologic storage medium or stored in non-physiologic conditions, with the extra-oral dry time less than 60 minutes

- If there is visible contamination, rinse the root surface with a stream of saline or osmolality-balanced media to remove gross debris.
- Check the avulsed tooth for surface debris. Remove any debris by gently agitating it in the storage medium. Alternatively, a stream of saline can be used to briefly rinse its surface.
- Put or leave the tooth in a storage medium while taking a history, examining the patient clinically and radiographically, and preparing the patient for the replantation.
- Administer local anesthesia.
- Irrigate the socket with sterile saline.
- Examine the alveolar socket. If there is a fracture of the socket wall, reposition the fractured fragment into its original position with a suitable instrument.
- Removal of the coagulum with a saline stream may allow better repositioning of the tooth.
- Replant the tooth slowly with slight digital pressure. Excessive force should not be used to replant the tooth back into its original position.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016” or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Suture gingival lacerations, if present.
- Initiate root canal treatment within 2 weeks after replantation
- Administer systemic antibiotics.
- Check tetanus status.
- Provide post-operative instructions.
- Follow up.

5.2.3 Avulsed permanent teeth with a closed apex: the tooth has been kept in a physiologic storage medium or stored in non-physiologic conditions, with the extra-oral dry time longer than 60 minutes

- Remove loose debris and visible contamination by agitating the tooth in physiologic storage medium, or with gauze soaked in saline. Tooth may be left in storage medium while taking a history, examining the patient clinically and radiographically, and preparing the patient for the replantation.
- Administer local anesthesia.
- Irrigate the socket with sterile saline.
- Examine the alveolar socket. Remove coagulum if necessary. If there is a fracture of the socket wall, reposition the fractured fragment with a suitable instrument.
- Replant the tooth slowly with slight digital pressure. The tooth should not be forced back to place.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016" or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Suture gingival lacerations, if present.
- Root canal treatment should be carried out within 2 weeks.
- Administer systemic antibiotics.
- Check tetanus status.
- Provide post-operative instructions.
- Follow up.

5.2.4 Avulsed permanent teeth with an open apex: the tooth has been replanted before the patient's arrival at the clinic

- Clean the area with water, saline, or chlorhexidine.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Leave the tooth in the jaw (except where the tooth is malpositioned; the malpositioning needs to be corrected using slight digital pressure).

- Administer local anesthesia, if necessary.
- If the tooth or teeth were replanted in the wrong socket or rotated, consider repositioning the tooth/teeth into the proper location for up to 48 hours after the trauma.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016" or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Suture gingival lacerations, if present.
- Pulp revascularization, which can lead to further root development, is the goal when replanting immature teeth in children. The risk of external infection-related (inflammatory) root resorption should be weighed against the chances of revascularization. Such resorption is very rapid in children. If spontaneous revascularization does not occur, apexification, pulp revitalization/ revascularization, or root canal treatment should be initiated as soon as pulp necrosis and infection is identified.
- Administer systemic antibiotics.
- Check tetanus status.
- Provide post-operative instructions.
- Follow up.

5.2.5 Avulsed permanent teeth with an open apex: the tooth has been kept in a physiologic storage medium or stored in non-physiologic conditions, and the extra-oral time has been less than 60 minutes

- Check the avulsed tooth and remove debris from its surface by gently agitating it in the storage medium. Alternatively, a stream of sterile saline or a physiologic medium can be used to rinse its surface.
- Place or leave the tooth in a storage medium while taking the history, examining the patient clinically and radiographically and preparing the patient for the replantation.
- Administer local anesthesia.
- Irrigate the socket with sterile saline.

- Examine the alveolar socket. Remove coagulum, if necessary. If there is a fracture of the socket wall, reposition the fractured segment with a suitable instrument.
- Replant the tooth slowly with slight digital pressure.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016" or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Revascularization of the pulp space, which can lead to further root development, is the goal when replanting immature teeth in children. The risk of external infection-related (inflammatory) root resorption should be weighed against the chances of revascularization. Such resorption is very rapid in children. If spontaneous revascularization does not occur, apexification, pulp revitalization/revascularization, or root canal treatment should be initiated as soon as pulp necrosis and infection is identified.
- Administer systemic antibiotics.
- Check tetanus status.
- Provide post-operative instructions.
- Follow up.

5.2.6 Avulsed permanent teeth with an open apex: the tooth has been kept in a physiologic storage medium or stored in non-physiologic conditions, and the extra-oral time has been longer than 60 minutes

- Check the avulsed tooth and remove debris from its surface by gently agitating it in the storage medium. Alternatively, a stream of saline can be used to rinse its surface.
- Place or leave the tooth in a storage medium while taking the history, examining the patient clinically and radiographically and preparing the patient for the replantation.
- Administer local anesthesia, preferably with no vasoconstrictor.
- Irrigate the socket with sterile saline.

- Examine the alveolar socket. If there is a fracture of the socket wall, reposition the fractured segment with a suitable instrument.
- Replant the tooth slowly with slight digital pressure.
- Verify the correct position of the replanted tooth both clinically and radiographically.
- Stabilize the tooth by flexible splinting such as wire of a diameter up to 0.016" or 0.4 mm for 2 weeks. In cases of associated alveolar or jawbone fracture, a more rigid splint is indicated and should be left in place for about 4 weeks.
- Suture gingival lacerations, if present.
- Revascularization of the pulp space, which can lead to further root development and maturation, is the goal when replanting immature teeth in children. The risk of external infection-related (inflammatory) root resorption should be weighed against the chances of revascularization. Such resorption is very rapid in children. If spontaneous revascularization does not occur, apexification, pulp revitalization/revascularization, or root canal treatment should be initiated as soon as pulp necrosis and infection is identified.
- Check tetanus status.
- Provide post-operative instructions.
- Follow up.

5.3 Splinting Technique [6, Level III]

Avulsed teeth must always be stabilized to ensure the replanted tooth remains in the correct position. During the first phase, it is necessary to use a splint to immobilize the teeth, since this is crucial for the regeneration of the periodontal ligament.

- Stabilize the tooth for 2 - 4 weeks using a passive flexible splint such as wire of a diameter up to 0.016″or 0.4 mm bonded to the tooth and adjacent teeth away from the gingival tissues and proximal areas.
- Second option is nylon fishing line (0.13–0.25 mm) which can be used to create a flexible splint, using composite to bond it to the teeth. Nylon (fishing line) splints are not recommended for children with mixed dentition.

5.4 Patient Instruction [4, Level III]

- Restrict diet to soft food for up to 2 weeks.

- Avoid participation in sports.
- Maintain good oral hygiene to improve healing of oral tissues.
- Brush with a soft toothbrush and rinse with chlorhexidine 0.12% twice daily.
- Use a chlorhexidine (0.12%) mouth rinse twice daily for 2 weeks If unable to rinse, apply to teeth and gums twice daily using a soft toothbrush and then expectorate excess. Do not rinse with water for 30 min.

Note: For young children, it is recommended to use chlorhexidine without alcohol (SEPTYL ® MOUTHWASH).

5.5 Systemic antibiotic prescriptions [4, Level III]

a. Indications for antibiotic use

Antibiotics may be indicated under the following conditions:

- Delayed **replantation (permanent tooth)**: the tooth has been outside the mouth for an extended period (more than 60 minutes).
- **Soft tissue injury or contamination**: the tooth and surrounding tissues have been contaminated by soil, dirt, or other foreign materials.
- **Signs of infection**: swelling, erythema, or pus discharge from the socket or soft tissues.
- **Severe traumatic injury**: complex trauma involving other soft tissue damage and a high risk of infection.

b. Recommend antibiotic regimen

- **First-line treatment (Amoxicillin)**:
  - Children: 50 mg/kg/day divided into three doses for 7-10 days.
  - Adults: 500 mg every 8 hours for 7-10 days.
- **Alternative Antibiotic for Penicillin-Allergic (Clindamycin)**:
  - **Children**: 10-20 mg/kg/day divided into three doses for 7-10 days.
  - **Adults**: 300 mg every 6-8 hours for 7-10 days.

5.6 Follow up procedures

Replanted teeth should be monitored clinically and radiographically at the following intervals: 2 weeks (with splint removal), 4 weeks, 3 months, 6 months, one year, and annually thereafter for a minimum of five years [7, Level III].

5.7 Prognosis [7, Level III]

Not all avulsed permanent teeth are suitable for replantation. The decision depends on several
clinical factors such as extraoral dry time, the tooth's condition, the injury's circumstances, and the patient's systemic health.

Indications to replantation

- **Permanent** tooth with favorable conditions (e.g., extraoral dry time <60 minutes, root and periodontal ligament (PDL) are intact or minimally damaged) are suitable for replantation
- Tooth that has been out of the mouth for less than 60 minutes or stored in a suitable medium.

Contra-indications to replantation

- Prolong dry time (>60 minutes): the periodontal ligament (PDL) cells are non-viable leading to poor outcomes (e.g., ankylosis or root resorption).
- Severe root or crown damage
- Patient with systemic diseases (e.g., severe immunosuppression, poorly controlled diabetes)

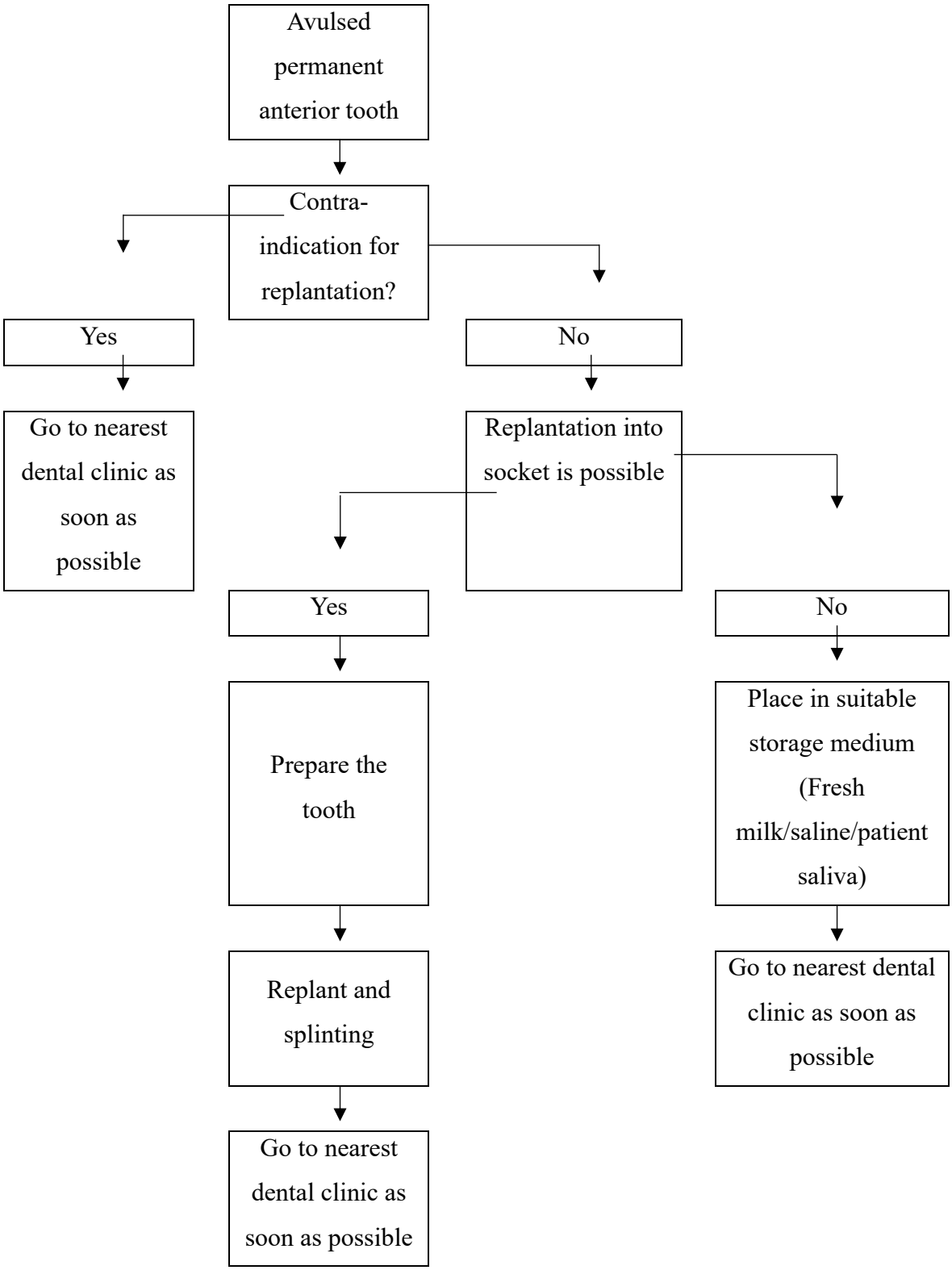
c. Exception for specific tooth

- Mature **Permanent Teeth (Closed Apex)**: replantation is often performed, but root canal therapy is required within 7–10 days to prevent infection and external root resorption.
- **Immature Permanent Teeth (Open Apex)**: replantation is highly recommended to promote revascularization. If pulp necrosis develops, apexification or regenerative endodontic treatment is initiated.

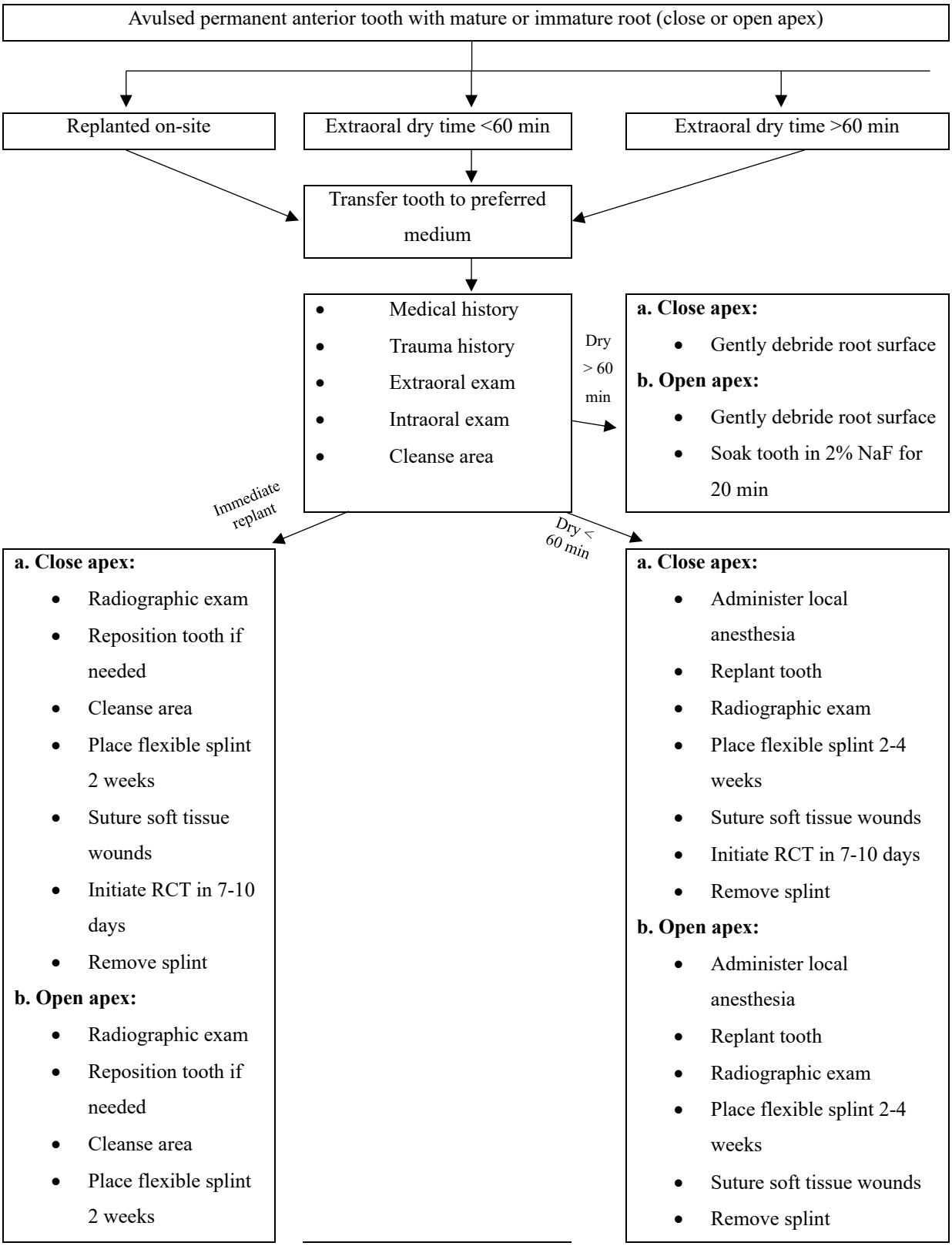
Key message 2
1. If the extra oral dry time >60 minutes, the prognosis decrease significantly, but replantation may still be performed as a temporary measure until a long term prosthetic solution can be considered. 2. Prognosis based on timing: • <15 minutes: best outcomes, high chance of PDL survival • 15-60 minutes: reduce success, store the tooth in a suitable medium until replantation • >60 minutes: poor prognosis, often leads to ankylosis or root resorption

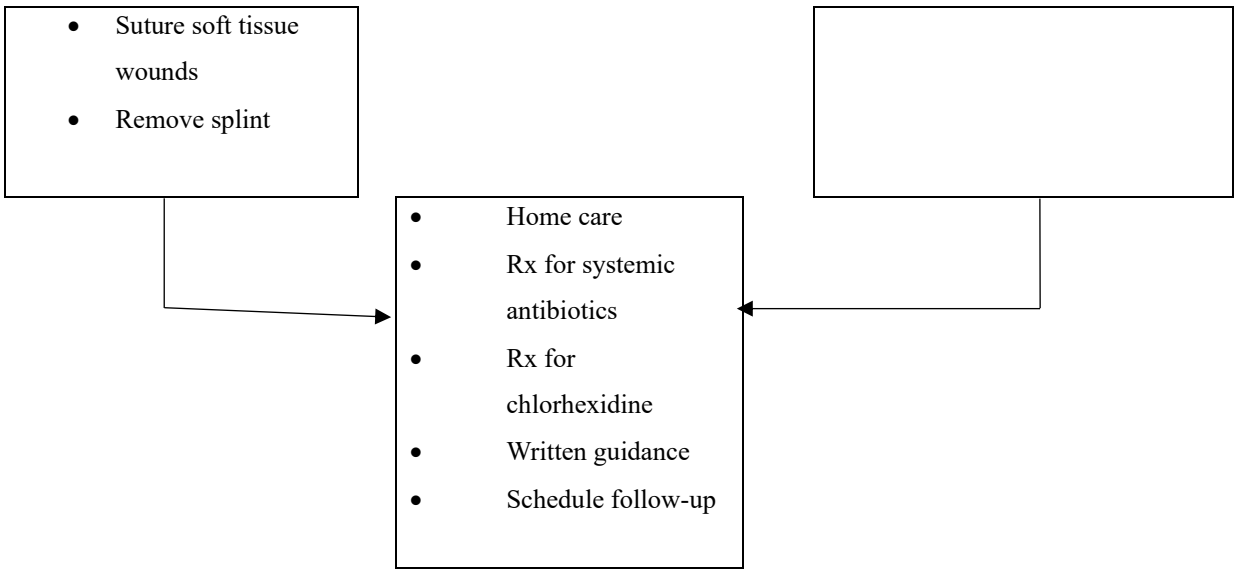
VI. ALGORITHM

5.1 MANAGEMENT OF AVULSED PERMANENT ANTERIOR TOOTH WITH MATURE AND IMMATURE ROOT (CLOSE OR OPEN APEX)AT THE SITE OF INCIDENT



5.2. MANAGEMENT OF AVULSED PERMANENT ANTERIOR TOOTH WITH MATURE AND IMMATURE ROOT (CLOSE OR OPEN APEX) AT THE DENTAL CLINIC




Suture soft tissue wounds
Remove splint
Home care
Rx for systemic antibiotics
Rx for chlorhexidine
Written guidance
Schedule follow-up

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MOLAR INCISOR HYPOMINERALIZATION (MIH)

CHHE Phearom, DURWARD Callum, YOS Chantho, SIENG Chanthyda

I. INTRODUCTION

Molar incisor hypomineralization (MIH) is a condition first described in 2001 that affects the enamel of permanent first molars (PFMs) and often incisors, caused by disrupted enamel formation during tooth development. It can result in weak, discolored enamel that leads to rapid caries progression after eruption, posing significant challenges for patients and dentists. The condition has also been referred to as "hypomineralized permanent first molars (PFM), "idiopathic enamel hypomineralization," "dysmineralized PFMs","nonfluoride hypomineralization", and "cheese molars" [1, Level III].

Prevalence varies globally, from 2.8% to 40.2%, and it is estimated to affect one in six children worldwide. Studies show higher MIH rates in preterm children and those with low birth weight, linking these factors to increased risk [2,3, Level II-2]

II. CASE DEFINITION

Molar-Incisor Hypomineralization (MIH) is defined as a qualitative developmental defect of enamel in children and adolescents, affecting at least one PFM with or without involvement of the incisors. MIH is clinically characterized by more or less well-defined opacities that vary in size and can be discolored from white to yellow-brownish. [4, Level III]

III. ETIOLOGY

The etiologies of MIH can be divided into five groups: (1) Exposure to environmental contaminants, (2) pre/peri and neonatal problems, (3) exposure to fluoride, (4) common childhood illnesses, and (5) medically compromised children. MIH etiological factors are still uncertain. It is likely that childhood illnesses and genetic factors are involved, and possibly there is an individual threshold for susceptibility as many children without relevant medical histories are severely affected by MIH and vice versa. [3, Level II-2]

IV. DIAGNOSIS

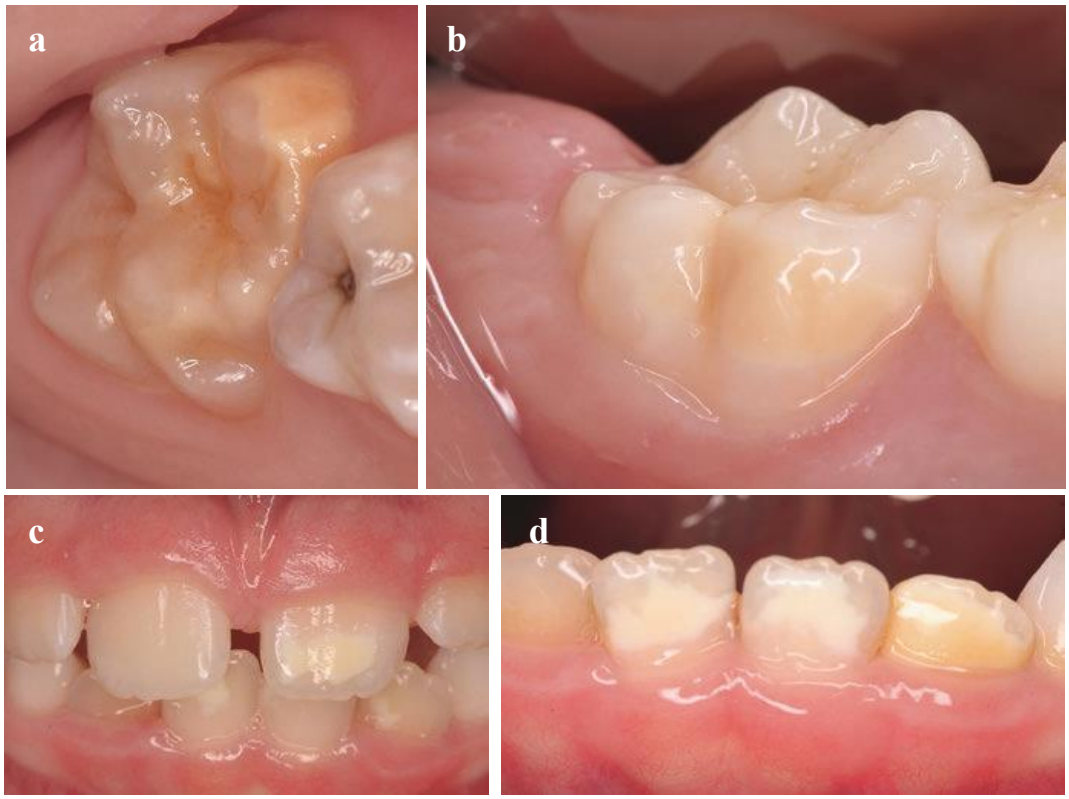
An optimum age for checking the condition is 8 years (as all four permanent molars and most permanent incisors should have erupted). Teeth should be examined wet; however, if needed, then cotton rolls may be used to clean tooth surface to better visualize it. The following judgement criteria should be used to identify teeth affected by MIH: [5, Level III]

- **Demarcated** opacities.
- Post eruptive enamel breakdown (PEB).
- Atypical restoration
- Extraction of permanent first molars due to MIH.
- Failure of eruption of a molar or an incisor.

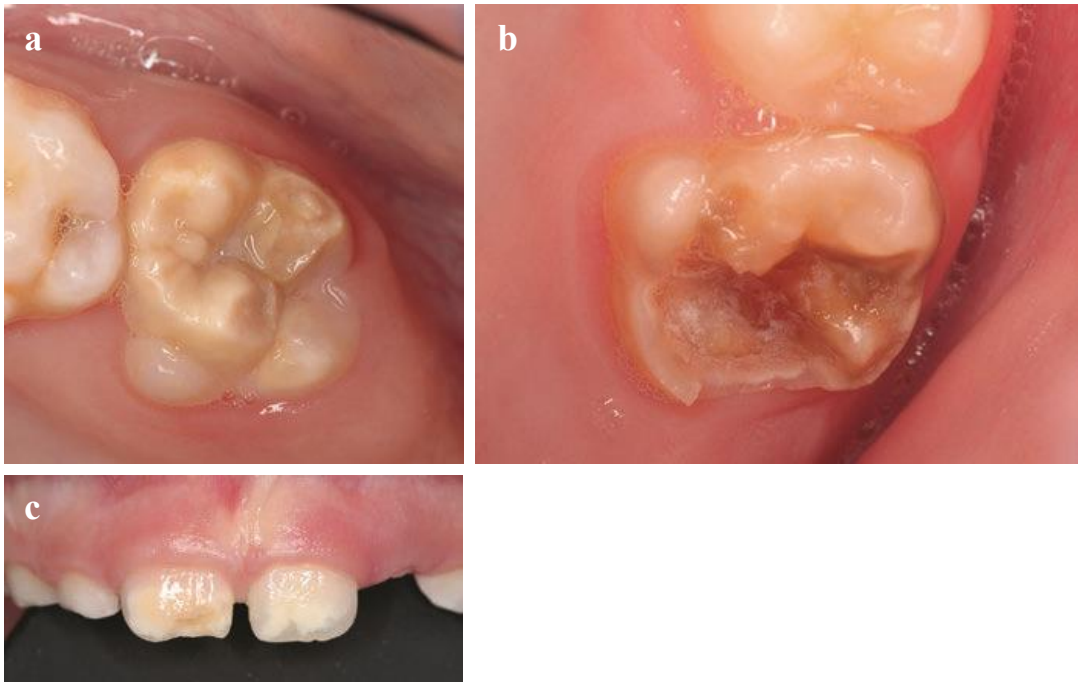
Table 1: Judgement criteria for diagnosing MIH

Key feature	**Description**
Demarcated opacities	• Clearly demarcated opacities • Variability in color and size • Defects less than 1 mm not to be reported
Post eruptive enamel breakdown	• Defect of the surface after eruption of the tooth • Loss of enamel from an initially formed surface after tooth eruption • Frequently associated with a pre-existing demarcated opacity
Atypical restorations	• Size and shape of restorations not conforming to the temporary caries picture • Frequently extends to the buccal and palatal/lingual surfaces • Frequently associated with an opacity at the margin of the restoration • For incisors, a buccal restoration can be noticed not related to trauma

Extraction of molars due to MIH	• Absence of a first permanent molar should be related to the other teeth of the dentition • Opacities or atypical restorations in the other first permanent molars combined with absence of a first permanent molar • Absence of first permanent molars in an otherwise sound dentition in combination with demarcated opacities on the incisors
Failure of eruption of a molar or an incisor	• First permanent molar or the incisor to be examined are not yet erupted



Demarcated opacities in enamel of molars and incisors. (**a**) Tooth 16: Opacities on the occlusal, buccal and palatal surface in the mesial half. (**b**) Tooth 46: Opacity on the buccal surface. (**c**) Tooth 21, 32 and 41 showing opacities. (**d**) Tooth 32, 31 and 41: Opacities in different colors



Post eruptive breakdown of molars and incisors. (**a**) Tooth 26: Post eruptive breakdown on the mesio-palatal and disto-buccal cusp. (**b**) Tooth 26: Post eruptive breakdown affecting nearly two-thirds of the occlusal surface. (**c**) Tooth 11: Post eruptive breakdown on the upper third

RECOMMENDATION

- The importance of early diagnosis and appropriate treatment planning cannot be underestimated. Therefore, if a child has had Hypomineralised Second Primary Molar (HSPM), then due to increased risk, the presence of MIH should be determined as soon as after the eruption of the first permanent molars as possible.

(Grade C)

4.1 Differential diagnosis

Molar incisor hypomineralization may be mistaken for a range of other conditions. Therefore, it is essential to distinguish between MIH and other abnormalities in the dental structures. Besides understanding the key features which are essential for accurate diagnosis, a patient's history is mandatory for seeking acquired, environmental or genetic etiologies. 6,7, Level III

4.1.1 Amelogenesis Imperfecta

Amelogenesis imperfecta (AI) is a genetic condition affecting enamel development. It leads to enamel that is thin (hypoplastic), poorly mineralized (hypomineralized), or underdeveloped (hypomature). AI can sometimes be mistaken for MIH due to similar clinical features.

Amelogenesis imperfecta

4.1.2 Enamel hypoplasia

Enamel hypoplasia is a condition where the quantity of enamel is reduced, leading to thin enamel with pits, grooves, or irregular missing areas. In contrast, molars affected by MIH often experience rapid enamel breakdown after eruption.

Enamel hypoplasia

4.1.3 Fluorosis

Dental fluorosis occurs as a result of excessive fluoride absorption during tooth mineralization. Clinically affected teeth show linear, patchy, or confluent white, yellow, or

brown opacities without a clear boundary in the enamel. In contrast, MIH does not show diffuse opacities but demarcated opacities.

Dental Fluorosis

4.1.4 White Spot Lesions

White spot lesions represent early signs of tooth decay. They can be seen as a result of prolonged plaque accumulation on the affected surface of the teeth and a high sugar diet. White spot lesions can be distinguished from MIH because they occur in vulnerable areas of plaque stagnation, such as the cervical or gingival margin of the tooth.

White spot lesions

4.1.5 Traumatic Hypomineralisation

This is associated with a history of dental trauma to the primary predecessor tooth. Periapical infection of the primary tooth can disturb mineralization of the underlying tooth germ. It has a wide variety of clinical presentations differing in shape, outline, localization and color. It is often limited to one tooth.

Traumatic Hypomineralization

4.2 Classification of MIH

The MIH Treatment Need Index (MIH-TNI) was designed for describing treatment needs in populations and for identifying patients and providing information about the severity of MIH. The index is based on two key symptoms which are clinically considered to be the most important ones with respect to MIH: hypersensitivity and post-eruptive enamel breakdown (PEB). [8,9,10, Level II-3]

Table 2: MIH-TNI

Index	**Definition**		
Index 0	No MIH		
Index 1	MIH • No hypersensitivity • No enamel breakdown		
Index 2	MIH • No hypersensitivity • Enamel breakdown	2a 2b 2c	<1/3 extension of defect >1/3<2/3 extension of defect >2/3 extension of defect or/and defect close to pulp

			or extraction or atypical restoration
Index 3	MIH • Hypersensitivity • No enamel breakdown	2	
Index 4	MIH • Hypersensitivity • Enamel breakdown	4a 4b 4c	<1/3 extension of defect >1/3<2/3 extension of defect >2/3 extension of defect or/and defect close to pulp or extraction or atypical restoration

MIH-TNI 1	MIH-TNI 2	MIH-TNI 3	MIH-TNI 4

RECOMMENDATIONS FOR DIAGNOSIS

- Identify MIH as early as possible.
- Carry out a thorough history and examination – including PBW and panoramic radiographs.
- Make a diagnosis based on history, clinical and radiographic appearance.

(Grade B)

V. MANAGEMENT

Treatment options for teeth with MIH include prevention, restoration and extraction. A six-step management approach for a child with MIH is described: (1) Risk identification, (2) early diagnosis, (3) remineralization and desensitization, (4) prevention of caries and post eruption breakdown, (5) restorations and extractions, and (6) maintenance (Table 3). [11, Level III]

Table 3: A Clinical Management Approach for MIH teeth

Step	**Recommended procedures**
Step 1: Risk identification	• Assess medical history for putative etiological factors
Step 2: Early diagnosis	• Examine at-risk molars on radiographs (if available) • Monitor these teeth during eruption
Step 3: Remineralization and desensitization	• Apply localized topical fluoride
Step 4: Prevention of dental caries and post-eruption breakdown (PBE)	• Institute through oral hygiene home care program • Reduce cariogenicity and erosivity of diet • Place pit and fissure sealants
Step 5: Restorations or extractions	• Place intracoronal (resin composite) bonded with a self-etching primer adhesive or extracoronal restorations (stainless steel crowns) • Consider orthodontic outcomes post-extraction
Step 6: Maintenance	• Monitor margins of restorations for prevention-based approach • Consider full coronal coverage restorations in the long term

7.1 Prevention

During PFM eruption, the hypomineralized surface is very susceptible to caries and erosion. Preventive measures to be employed include the following:

7.1.2 Dietary contro

D

The cariogenicity and erosivity of the child's diet should be assessed and appropriate recommendations made for dietary modification, focusing on sugar and acidic food/drink reduction.

7.1.3 Remineralization therapy

This should commence as soon as the defective surface is accessible, aiming to produce a hypermineralized surface layer and to desensitize the tooth. Remineralization and desensitization may be accomplished with: [12,13, Level I]

7.1.3.1 CPP-ACP:

- A topical tooth crème (e.g. Tooth Mousse or MI Paste, GC Corporation, Tokyo, Japan) – apply to affected teeth daily with a cotton bud or finger.
- A CCP-ACP sugar-free chewing gum (e.g. Recaldent Pty Ltd, Melbourne, Australia) – chew several times per day.

7.1.3.2 Topical fluorides:

- Fluoride varnish (50mg NaF/mL (2.26% F, 22,600 ppm F) – apply to affected teeth at least every 6 months.
- Fluoride gel (e.g. Gelkam, Colgate) containing 0.4% SnF (3,000 ppm Sn and 1,000 ppm F) – apply to teeth every 6 months.
- Silver diamine fluoride (SDF) – 38% - apply to teeth every 6 months
- High fluoride toothpaste (e.g. Colgate 5000 ppm) – use instead of standard toothpaste.

5.1.4 Oral hygiene

Thorough oral hygiene should be instituted; this could include a desensitizing toothpaste. Where tooth-brushing is difficult due to sensitive, poorly mineralized surfaces it is recommended to brush the affected molars gently with a desensitizing toothpaste (preferably containing fluoride) on a soft toothbrush.

5.1.5 Fissure sealants

Apply resin or GIC fissure sealants to susceptive surfaces soon after eruption. Resin fissure sealants should be placed before breakdown occurs and when the tooth is fully erupted and moisture control is adequate. In cases where the tooth is not fully erupted and/or isolation is difficult to achieve, glass ionomer cements (GIC) can be considered as an interim preventive option. [14, Level III]

7.2 Restoration of MIH-Affected Molars

5.2.1 Direct restorations [15, Level III]

- Glass ionomer cements (GIC)
- Resin-modified glass ionomer cements (RMGIC)
- Polyacid modified resin composites (PMRC)
- Resin composites (RC)
- Stainless steel crown (SSCs)

5.2.2 Indirect restoration of MIH [16, Level III]

- Metal alloys or ceramic
- Resin composites
- CAD/CAM

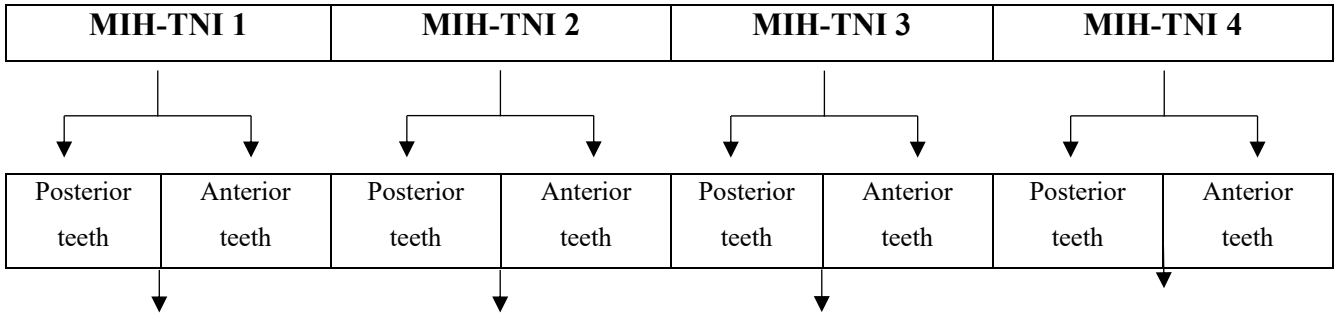
5.3 Treatment of MIH for Affected Incisors [17, Level III]

- Remineralization strategies
- Bleaching
- Micro abrasion
- Resin infiltration
- Composite restoration

5.4 Extraction [18, Level III]

When permanent first molars (PFMs) are severely hypomineralized and restorations are not possible, extraction may be necessary. Early orthodontic assessment is crucial, as PFMs are rarely the preferred choice for orthodontic extractions, which can complicate later treatment. Factors like tooth vitality, restorability, dental age, crowding, occlusion, and the condition of other teeth must be evaluated. If restoration fails, extracting the first molar around age 9-10 is ideal, as the second molar can often erupt into its place, supporting proper occlusion and alignment.

VI. ALGORITHM FOR MANAGEMENT OF MIH



Therapy A **A1:** (At home) Fluoride, Tri-Calcium phosphate, CPP-ACP **A2:** (In office) Fluoride varnish	**A1 and A2**		**A1 and A2**		**A1 and A2**		**A1 and A2**	
Therapy B **B1:** Sealant (adhesive + sealer or flowable) **B2:** GIC (low viscosity) **B3:** Bleaching **B4:** Micro-abrasion **B5:** Infiltration **B6:** Etch-bleach-seal	**B1 or B2**	**B3-B6** single or in combination	TNI 2a: **B1** or **B2** breakdown not located in fissure	**B3-B6** single or in combination	**B1 or B2**	**B3-B6** single or in combination	TNI 4a: **B1 or B2** breakdown not located in fissure	**B3-B6** single or in combination
Therapy C **C1:** GIC **C2:** GIC plus Orthoband			TNI 2a/2b/2c:				TNI 4a/4b/4c:	

C3: SDF plus GIC **C4:** SDF			**C1 or C2, C3 or C4** non-compliance, caries				**C1 or C2, C3 or C4** non-compliance, caries	
Therapy D **D1:** Crown (SSC, Zirconia)			TNI 2a/2b/2c: **D1**				TNI 4a/4b/4c: **D1**	
Therapy E **E1:** Direct restoration (composite) **E2:** Indirect restoration		**E1 or E2**	TNI 2a/2b/2c: **E1 or E2**	**E1 or E2**		**E1 or E2**	TNI 4a/4b/4c: **E1 or E2**	**E1 or E2**
Therapy F **F1:** Extraction			TNI 2c: **F1**				TNI 4c: **F1**	

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Chapter 6:

Orthodontics

1. **Management of Anterior crossbite in Mixed dentition**
2. **Early Prevention of Malocclusion in Mixed Dentition**

MANAGEMENT OF ANTERIOR CROSSBITE IN MIXED DENTITION

SAR sereiboth, SETH mana, KHORN sophea, SAN valine,
TRAK samoeun, HENG sreynich, CHEANG mengchou

I. INTRODUCTION

Anterior dental crossbite has a reported incidence of 4–5% and usually becomes evident during the early mixed-dentition phase[3 Level I, 1 Level III].

Anterior dental crossbite has a reported incidence of 4-5% and is usually the result of a palatal malposition of the maxillary incisors[3 level I].

II. CASE DEFINITION

Anterior crossbite is defined as a malocclusion resulting from the lingual positioning of the maxillary anterior teeth in relationship to the mandibular anterior teeth (Figure 1)[1 level III].

Figure 1. This permanent maxillary right central incisor erupted into crossbite. Most likely this was caused by the lingual position of the tooth bud.

Type of anterior crossbite

Dental anterior crossbite: This type involves only the misalignment of teeth, without affecting the positioning of the jaws. It is typically caused by factors such as tooth crowding, delayed eruption.

1. **Skeletal anterior crossbite:** is a type of malocclusion caused by a discrepancy in the growth of the jaws, where the lower jaw is overgrown, or the upper jaw is underdeveloped; causing teeth to bite on the inside of one another. Adding photos

2. **Funcional anterior crossbite (Pseudo class III):** A change in anterior function during closure from centric relation to centric occlusion due to habit of placing the mandible forward can lead to an anterior crossbite. It may be the result of premature occlusal interference that forces the lower jaw to move forward or laterally to achieve maximum occlusion. Malaysia

III. ETIOLOGY

A variety of factors have been reported to cause anterior crossbite; these including factors as following:

Dental

- a lingual eruption path of the maxillary anterior incisors
- crowding in the incisor region due to inadequate arch length

Skeletal

- Discrepancy in growth between upper and lower jaw
- Genetic conditions; family history,
- Congenital facial malformations or syndromes Medical related diseases involve with midface deficiency and abnormal dentition.

Local factor

- trauma to the primary incisor resulting in lingual displacement of the permanent tooth germ
- Obstruction of eruption path; an over-retained necrotic or pulpless deciduous tooth or root; odontomas; supernumerary tooth
- a habit of biting the upper lip.

Pathological conditions

- cleft lip and palate

IV. EARLY INTERVENTION

Anterior crossbite may potentially have a detrimental effect on the development of skeletal and dentoalveolar structures. Therefore, early correction around 6-10 years old is important to prevent the problem from worsening and becoming more difficult to manage. Early intervention typically starts when the permanent incisor(s) are erupting in a crossbite position (7-8 years old).

The rationale for early intervention are:

- a crossbite has little possibility of self-correction
- a crossbite in the primary dentition may lead to development of crossbite in the permanent dentition, postponing treatment may result in prolonged treatment of greater complexity

- a functional crossbite can develop from cuspal interference, resulting in a mandibular shift to improve maxillary lip posture and facial appearance

Implications of delayed or no treatment

KEY MASSAGE

Prevention and early treatment of abnormal habit and mouth breathing is important for the prevention the development of malocclusion or worsening the existing condition.

If left untreated, anterior crossbite may lead to:

- damage to the teeth in crossbite through attrition.
- mobility of the lower incisor due to labial displacement of this tooth accompanied by loss of gingival attachment labially.
- gingival recession and loss of alveolar bone support to the opposing lower incisor.
- the potential adverse growth influences on the mandible and anterior portion of the maxilla.
- constant protrusion of the mandibular condyle from the fossa may stimulate growth of the mandible.

Consideration before embarking on early intervention (interceptive treatment) :

The following factors need to be considered before early intervention of anterior crossbite in mixed dentition:

- oral hygiene status
- the severity of the underlying skeletal discrepancy
- the amount of dentoalveolar compensation that has taken place (proclined upper incisors and retroclined lower incisors)
- the amount of overbite present
- patient's compliance
- patient's overall health condition

V. DIAGNOSIS

KEY MASSAGE

Proper diagnosis must be made to evaluate the cause of anterior crossbite; dental based or skeletal based.

The diagnosis of anterior crossbite is based on the following criteria:

1. **History taking**

Dental History

- History of over-retained primary teeth.
- History of local factor involve obstruction of eruption pathway such as supernumerary tooth or odontoma.
- Family history with class III skeletal pattern
- Abnormal Habit

Medical history

- Present of midface or maxillary deficiency in genetic conditions such as Crouzon Syndrome, ect.

Clinical Examination

Clinical assessment should be performed to identify the type of anterior crossbite.

Extra-oral examination

- Facial profile: to evaluate the soft tissue and skeletal relationship of maxilla and mandible.
- Lip position: with or without retruded of upper lip

Figure 2: Extra oral photograph

Intra-oral Examination

An intra-oral examination should be conducted for the presence of the following:

- General condition:
    - Oral hygiene and DMF status
    - Gingival health
    - Gingival recession
    - Tooth mobility
    - Tooth attrition
- Assessment of dental arch:
    - Severity of crowding
    - Spacing availability for alignment
    - Upper and lower incisors inclination
- Occlusion:
    - Number of teeth involved in crossbite
    - *Molar relationship:* present with Angle class III molar relationship, Angle class I molar relationship with anterior crossbite.
    - *Incisor relationship:* reverse overjet (mm), overbite
    - Able to achieve edge-to-edge incisor relationship
    - *Functional shift:* Any mandibular displacement in closure. Using a Lucia Jig or Bimanual manipulation technique to guide mandible into centric relation to assess the jaws relationship.
    - centreline discrepancy
    - Buccal segment relationship

Evaluation areas	**Dental crossbite**	**Skeletal crossbite**
Clinical features		
Facial profile	- Concave facial profile* *less likely present with concave profile	+Concave facial profile
Lip position	Normal lip	Retruded lip

Arch and Occlusion	Crowding & lack of space Molar class I	Usually well aligned dentition Molar class III
Incisor inclination	Retroclination of upper incisors	Usually present with proper incisor inclination but misalign between upper and lower jaw.
Number of teeth involved	1-2 teeth	Multiple teeth
Lateral cephalometric analysis	Favorable A and B points	Discrepancy between A and B points
Skeletal maturation index	Stages of CVM	Stages of CVM

Figure 3: Intra oral photograph

2. Investigation

KEY MASSAGE

The management of anterior crossbite requires a proper diagnosis. • Record taking is crucial for evaluation, monitoring treatment progress medico-legal purposes.

Extra-oral and intra-oral photograph and Model analysis are the essential tools for record documentation and assessment.

Radiographic

The following radiographs may aid in the diagnosis and management:

- **Panoramic Radiograph/ Orthopantomogram (OPG)**: gives a thorough overview of the teeth, jaws, and surrounding structures in the entire dentition. When it comes to mixed dentition anterior crossbite, it is especially helpful for:
  - Detecting impacted, unerupted, or missing teeth that may contribute to malocclusion.
  - Assessing the position of the growing permanent teeth as well as the growth of their roots.
  - Identifying any abnormalities in the bone such as dontoma, supernumerary teeth, cysts or tumors that prevent normal eruption of teeth.
- **Lateral Cephalogram**: is a radiographic image taken from the side of the head, primarily used to assess the relationship between the teeth, jaws, and facial bones (Figure 4).

KEY MASSAGE
Skeletal anterior crossbite involve with Class III molar and canine relationships, a concave profile, and horizontal growth. Cephalometric analysis shows reduced SNA, increased SNB, and negative ANB angles. The soft tissue profile suggests a Class III intermaxillary relationship with excessive forward positioning of chin tissues relative to the subnasale point[8] Level III.

It helps in evaluating[6] level III:

Maxillary Skeletal position:

- SNA: Measures the position of the maxilla relative to the cranial base.
  - SNA: A normal value is 81°, decreased mean retrognathic, increased mean prognathic of maxilla.
- Nper-A: Line from N Point perpendicular to Frankfort plane, measures from distance of the line to A point.
  - Nper-A: -1mm Normal maxillary, decreased mean retrognathic, increased mean prognathic of maxilla.

Mandibular skeletal position:

- SNB: Measures the position of the mandible relative to the cranial base.
  - SNB: A normal value is 79° (SD ±3),cdecreased mean retrognathic, increased mean prognathic of mandible.

- Nper-Pog: Line from N Point perpendicular to Frankfort plane, measures from distance of the line to Pog point. Pog point behind line (-) and Pog point infant of line (+)
    - Nper-Pog: -6mm Normal mandibular position, decreased mean retrognathic, increased mean prognathic of mandible.

Relationship between mandible and maxilla:

- ANB: Angle connection from N point to A point and N point to B point. if the B point moving forward to A point the angle is Negative (-).
    - ANB: A normal value is 2° is Skeletal Class I
    - ANB: Decrease less than norm is Skeletal Class II
    - ANB: Increase more than norm is Skeletal Class III

Mandibular dentoalveolar position:

- IMPA: Angle form by Mandibular plane and line from lower incisor age to apical. To assess the proclination of lower inciors.
    - IMPA: A normal value is 90° is Normal lower incisor inclination, decreased mean retroclination, increased mean proclination of lower incisors.

Maxillary dentoalveolar position:

- U1-FH: Angle form by Frank Fort plane and line from incisor age to apical.
    - U1-FH: 116° normal upper incisor position, decreased mean retroclination, increased mean proclination of inciors.

Vertical components:

- FMA: Angle formed by line from Ar to Go and Mandibular plane (Go to Me). Assess the divergent of the face.
    - FMA: Normal facial high is 22°-28°, decreased mean mandibular low angle (hypodivergent face), increased mean mandibular high angle (hyperdivergent face).

Soft tissue:

- Nasolabial angle: a normal value is 90-110°, Men: 90-95°, Women: 95-110°

Hand Wrist and Cervical radiograph:

- Fishman's skeletal maturity indicator: **S.M.I**
- Cervical Vertebrae Maturation: **CVM**
    - To assess to assess skeletal maturity by analyzing the shapes of the second, third, and fourth cervical vertebrae.

- prepubertal (CS1-CS2), the growth spurt (CS3-CS4), postpubertal periods (CS5-CS6)

Cephalometric landmarks	**Dental crossbite**	**Skeletal crossbite**
Clinical features		
SNA	Normal	○ Decreased (retrognathic maxilla with normal mandible) ○ Normal (prognathic mandible with normal maxilla)
SNB		○ Decreased (retrognathic maxilla with normal mandible) Normal (prognathic mandible with normal maxilla)
ANB	Normal lip	Retruded lip
Molar relationship	Molar class I	Molar class III
Incisor relationship	Retroclination of upper incisors	+/- Retroclination of upper incisors
Lateral cephalometric analysis	Favorable A and B points	Discrepancy between A and B points
Skeletal maturation index	Stages of CVM	Stages of CVM

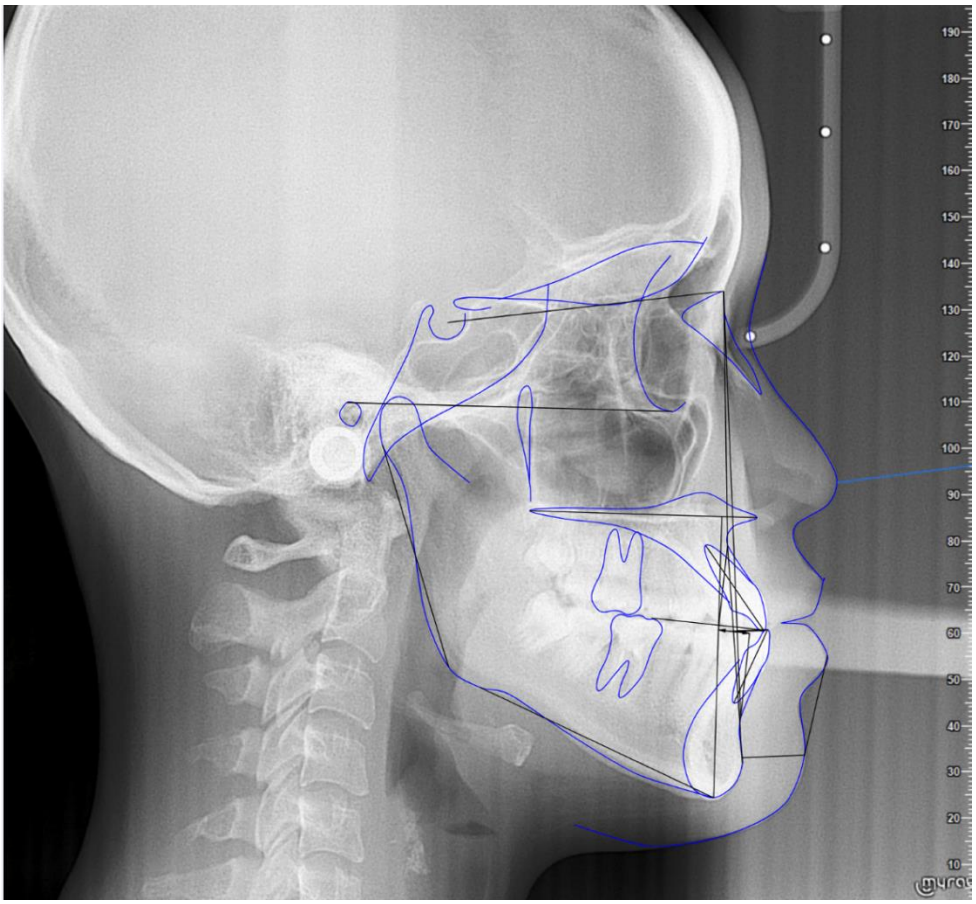


Figure 4: Cephalometric Analysis

VI. DIFFERENTIAL DIAGNOSIS

Differential diagnosis of dental versus skeletal anterior crossbite is essential in determining clinical treatment. This can be achieved by attempting to guide the mandible into a centric relation and evaluating the molar and incisor relationship: If the molars are in a Class I relationship and the incisors in an edge-to-edge relationship, a dental correction can be undertaken[11 Level II-2].

VII. MANAGEMENT

Dental crossbite involves localized tipping of a tooth or teeth and does not involve basal bone[11 Level II-2].

Skeletal anterior crossbite involve promote grow of upper jaw upper to correct the discrepancy of upper and lower jaw. Minimal discrepancy can be compensated by orthodontic camouflage.

The main goal in treating anterior dental crossbite is to tip the affected maxillary tooth or teeth labially to a point where a stable overbite relationship prevents relapse. Treatment may involve lingual movement of a mandibular tooth, labial movement of a maxillary tooth, or both[11 Level II-2]. Various techniques have been used to achieve this goal, such as tongue blades, composite inclined planes, removable acrylic appliances with lingual springs and fixed appliances [2 Level II-2].

KEY MASSAGE

- For patients with a Class I or mild Class III skeletal discrepancy, particularly those with a pseudo-Class III bite where the incisors can meet edge-to-edge in centric relation, the treatment prognosis is favorable.
- A stable overbite should be achieved at the end of treatment to ensure the corrected incisor relationship is maintained.

RECOMMENDATION

Present of anterior crossbite in mixed dentition should be corrected as early as possible to prevent possible leading to increase complexity.

Grade C

Management of Dental anterior crossbite[4,6 level I]:

Below are treatment options available.

Removable Appliances:

- **Hawley Appliance with Z Springs:** To correct anterior crossbite in young children, a removable appliance with finger springs or Z springs can push upper front teeth forward. Multiple clasps ensure retention, while labial bows are avoided as they hinder incisor movement and add minimal retention By William R. Proffit (Figure 5)[5 level III].
- **Lower inclined plane:** The inclined plane is used when there is enough space in the dental arch to procline upper incisors, especially in cases of crossbite with over half the vertical overbite. Tooth movement results from the interaction between closing muscle forces and the inclined plane. A wide acrylic base ensures stability, and teeth

with varying axial inclinations are preferred. The lower inclined plane caps the lower incisors at a 45° angle to the occlusal plane (figure 6)[9 level III].

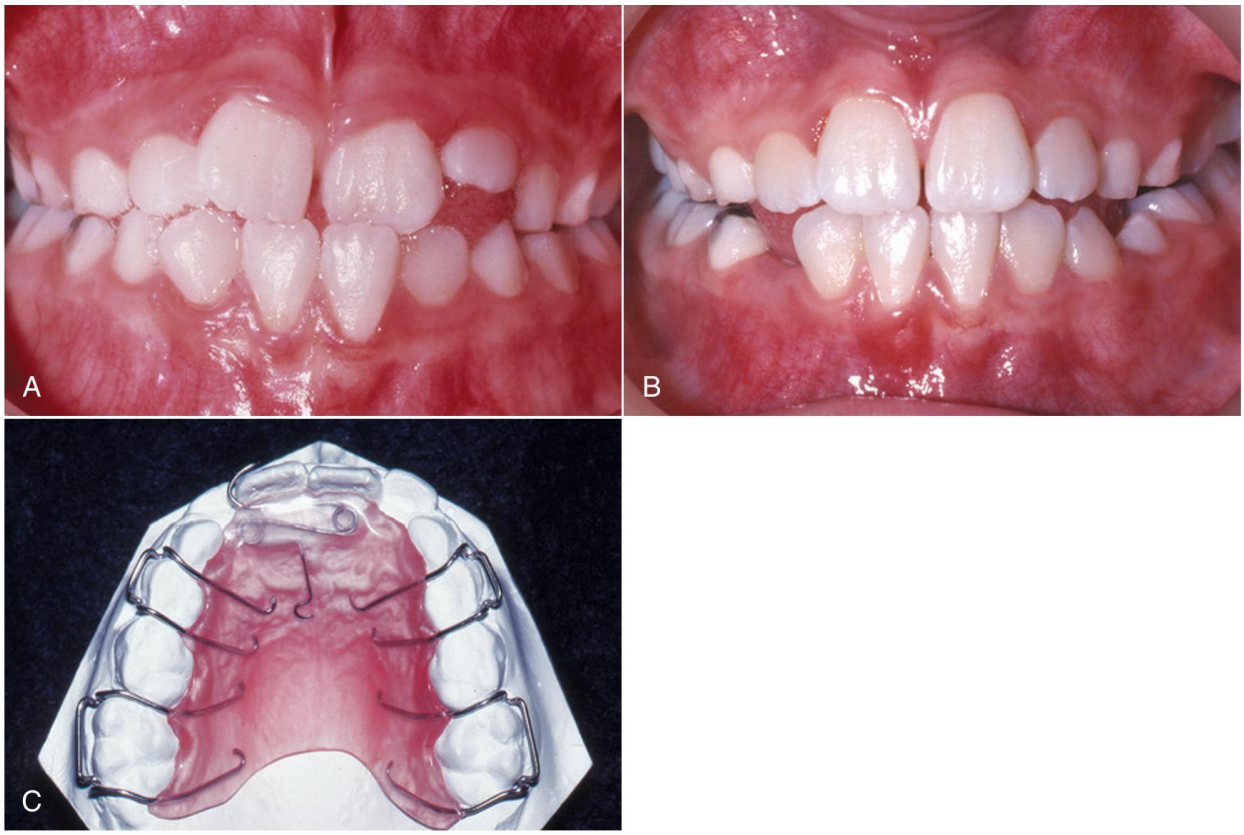


Figure 5: A removable appliance can correct anterior crossbite by tipping teeth forward. (A) A maxillary central incisor in crossbite (B) is corrected using a 22-mil double-helical fingerspring, activated 2 mm monthly for 1 mm of movement. The plastic baseplate stabilizes the spring, and Adams clasps ensure retention.

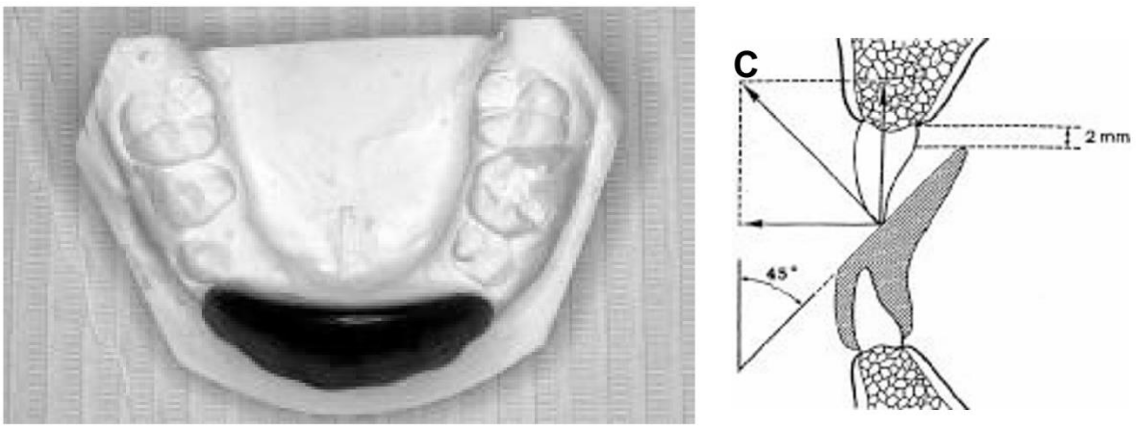


Figure 6: Acrylic lower inclined plane. The lower inclined plane caps the lower incisors and deciduous canines.

- **Fixed Appliances**:
  - **2x4 Appliance (Partial Braces)**: This involves bonding brackets on the four permanent upper front teeth and two molars to create a simple fixed appliance. It's effective for correcting the positioning of a few teeth while the rest of the dentition develops life (Figure 7).

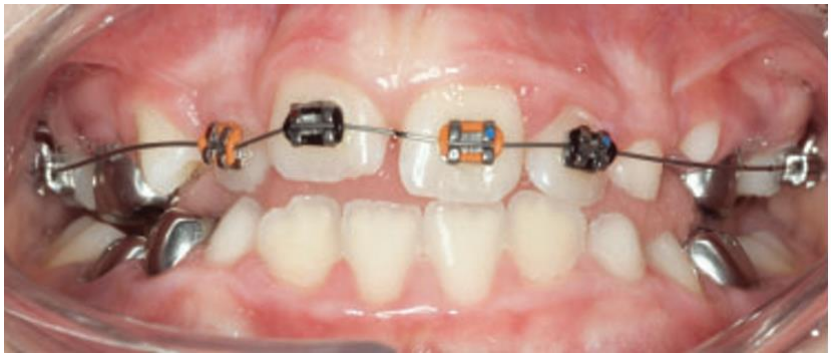


Figure 7: An example of a 2x4 fixed appliance (Picture by Felicity Borrie and David Bearn)

Management of Skeletal anterior crossbite

Functional Appliances in Treatment of maxillary deficiency

- **Facemask Therapy:** This appliance is commonly used in children with a skeletal anterior crossbite due to maxillary deficiency (underdeveloped upper jaw). It helps guide the upper jaw to grow forward, preventing the need for more invasive treatments later in life (Figure 8).

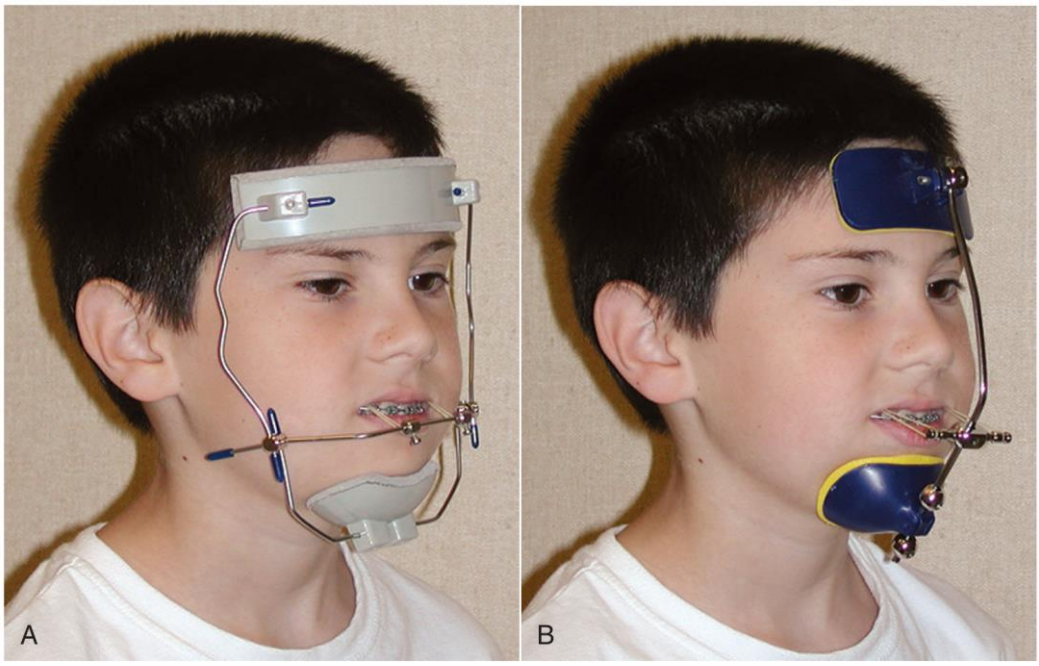


Figure 8. (A) The Delaire-type facemask offers good stability for maxillary protraction but can be bulky, causing issues with sleep and glasses. It may appear ill-fitted in cases of facial asymmetry. (B) The rail-style facemask is more comfortable, easier to adjust, and accommodates some vertical mandibular movement. Both types can cause skin irritation, which can be alleviated with fabric linings. Children may prefer one over the other, and switching types can improve cooperation.

- **Expansion Appliances:**
    - Rapid Palatal Expander (RPE): Used when the upper jaw is too narrow, this appliance widens the palate and corrects the crossbite. It's especially effective in younger children, as their sutures have not yet fused (Figure 9).
    - Quad Helix Appliance: A fixed appliance that expands the upper arch to provide space for the teeth to align properly.

Figure 9: (A) This banded palatal expander, attached only to the first molars in a patient in the mid mixed dentition, has been stabilized after expansion by using cold-cure acrylic so it will not relapse.

Functional Appliances in Treatment of Excessive Mandibular Growth

Functional appliances adjust jaw positioning by rotating the mandible downward and backward, guiding upper teeth forward while limiting lower teeth eruption, correcting Class III relationships, and masking discrepancies by tilting incisors[8 level III].

- **Chin Cap**: Chin-cup therapy redirects mandibular growth by rotating the chin downward and backward, reducing its prominence while increasing anterior face height. Growth restraint is usually temporary, and lower incisors may tip inward undesirably. Soft chin cups promote greater incisor uprighting, while lighter forces targeting rotation help minimize risks such as temporomandibular issues (Figure 10).

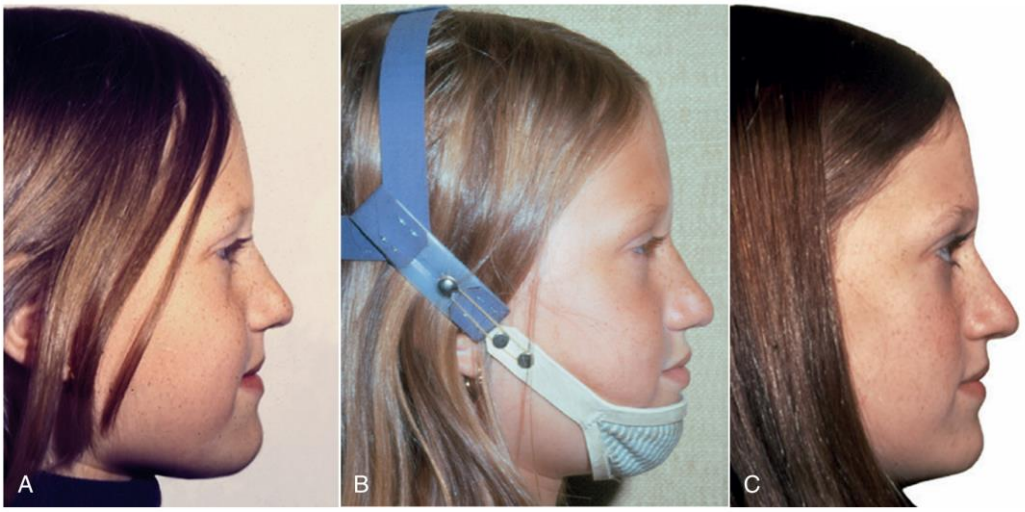


Figure 10. A typical response to chin-cup treatment. (A) Pretreatment profile, (B) chin-cup placement, (C) posttreatment profile.

KEY MASSAGE

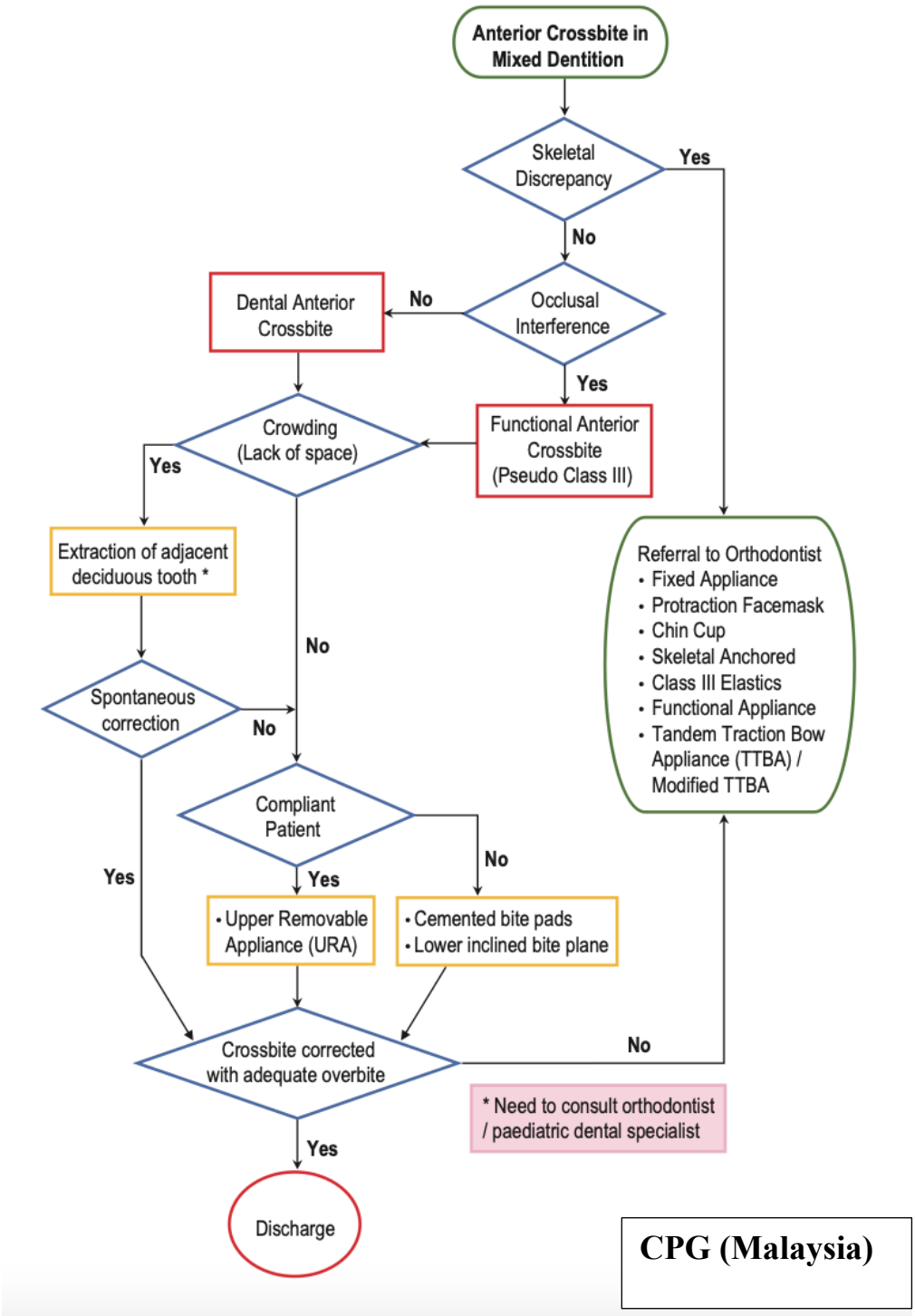
- Mandibular functional appliances offer no possibility of inhibiting the excessive growth. They are capable only of downward backward rotation of the mandible, which risks creating a long-face problem.
- If a patient has severe mandibular overgrowth and significant maxillary underdevelopment, or a long face, chin cup therapy may not be suitable. In such cases, orthognathic surgery is recommended.

Combination of Dental and Skeletal Treatments

- Early Orthodontic Treatment with Functional Appliances: If both dental and skeletal issues are present, a combination of fixed or removable appliances and functional appliances may be necessary to address both tooth positioning and jaw development. For example, an RPE combined with limited braces can correct both the upper jaw width and tooth alignment.

VIII. ALGORITHM

ALGORITHM ON MANAGEMENT OF ANTERIOR CROSSBITE IN THE MIXED DENTITION



CPG (Malaysia)

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EARLY PREVENTION OF MALOCCLUSION IN MIXED DENTITION

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I. INTRODUCTION

The early treatment of (non-skeletal and skeletal) orthodontic anomalies in the deciduous and early mixed dentition is improve children's oral health, dental alignment, and prevent malocclusions, and also to correct the developing problem, preventing complication, reducing later treatment complexity and reducing/elimination unknows[1 Level II-2]. In most of the cases, malocclusion starts during mixed dentition stage, and also the worldwide prevalence of its among children and adolescents was 56%, and higher percentage of malocclusion were found that in Africa was 81%, in Europe was 71%, in Asia was 48%, Malocclusion was carried out in this review such as Angle's classes, overjet, overbite, posterior crossbite, scissor-bite, midline-line shift, crowding, diastema[3 Level I].

II. CASE DEFINITION

Malocclusion refers to any misalignment of teeth or incorrect occlusion or relation between the teeth of the two dental arches[2 Level III; 11 Level II-2]. Malocclusions can be classified according to the three planes of space such as vertical (open and deep bite), transverse (posterior crossbite and scissor bite) and sagittal plane (angle's classification)[11 Level II-2].

III. ETIOLOGY

Malocclusion is caused by genetic and environmental factors. (Appendix 2: Table2, Table3)

- Craniofacial dimensions + size and number of teeth are determined genetically[2Level III]
- Dental arch dimensions are affected by environmental factors[2Level III]

IV. DIAGNOSIS

Diagnosis of malocclusion in mixed dentition of occlusion development is based on the following criterial[2 Level III]. (Appendix 1: Table1)

- **History taking**
  - **Medical and Dental History**
    - History of over retained primary teeth.
    - Family history with class I, II, III skeletal pattern
    - Present of midface or maxillary deficiency in genetic conditions such as Crouzon syndrome and experience with skeletal/dental trauma
    - Frequency of oral habits[5 Level I] (Appendix 7: Table 9)
      - Chewing on one side
      - Digit sucking, Pen biting, Nail biting, Cheek biting
      - Tongue thrust, Tongue sucking
      - Lip sucking or biting
      - Combined habits
    - Mouth-breathing
    - Early loss of deciduous teeth, especially primary molar (E), is one of the etiological factors of malocclusions[4 Level III].
    - Dental trauma or injury, dental caries
- **Clinical examination of Malocclusion**
  - **Extra-oral examination**
    - Difficulty chewing or biting
    - Speech difficulties
    - Facial asymmetry (severe malocclusion)
    - Jaw pain and discomfort
  - **Intra-oral Examination**
    - Intra-arch problems
      - Crowding
      - Dentoalveolar disproportion (discrepancy between tooth and jaw size)
      - Space loss (premature loss of primary teeth, delayed eruption of permanent teeth)
      - Local tooth displacement

- Spacing
- Missing teeth (congenital absence, traumatic loss)
- Supernumerary teeth
- Eruption of teeth
- Ectopic teeth or transpositions
- Impactions
- Retained deciduous teeth
- Tooth wear or damage

- Inter-arch problems
  - Increased overjet
  - Increased overbite
  - Open-bites: Anterior (most common) or lateral
  - Cross-bites: Anterior, posterior (unilateral or bilateral)
  - Tooth size discrepancies (Bolton's ratio)

- **Investigation**

Photograph records and model analysis (Dental impressions) are the essential tools for record documentation and assessment and also radiographic for assessment aid to diagnosis and treatment planning.

Radiograph examination

1. **OPG**: Alveolar bone height, teeth present or missing teeth, position of teeth, ectopic eruption, impacted teeth, supernumeraries, pathology, condyles etc.
2. **Lateral cephalometric**: Skeletal discrepancies
3. **Periapical radiograph**: Periodontal bone destruction, supernumeraries, periapical pathology, root Morphology.
4. **Upper anterior occlusal**: location of impacted teeth, supernumeraries or Pathology.
5. **Bitewing**: inter-proximal caries, quality of restoration, periodontal disease.

- **Treatment planning**[1 Level II-2]**:**

- Extractions
- The planned extraction of intensively carious first permanent molars (8 ½ to 10 years old)
- Balancing extractions of deciduous teeth
- Serial extraction
- Space maintenance
- Removable appliances
- Habit breakers
- 2x4 appliance (one arch only)
- 2x4 appliance (both arches)
- Functional appliance
- Arch expansion
- Face mask
- Mouthguard
- Periodic review
- Counseling

V. PREVENTION

KEY MESSAGE

Premature loss of deciduous teeth may cause crowding and/or midline shift. So, parents and caregivers should be vigilant about their child's oral habits and take them for regular dental check-ups.

RECOMMANDATION

The potential solution to prevent early malocclusion in mixed dentition that related with early loss of deciduous teeth is to improve health education and communication among the general public to maintain good oral hygiene practice[5 Level I].

Grade A

Prevention of premature loss of deciduous teeth play a major role in maintaining dental arch and facilitate with teeth eruption. This contributes indirectly to caries preventive. This should include:

- Instruction on maintenance of good oral hygiene:
  - Brushing behavior[10 Level III]:
    - Tooth brushing should be conducted so each tooth surface is reached and bushing should exceed 1 minute, also in preschool children.
    - Children should avoid rinsing with a lot of water after wards
    - Children's teeth should be brushed using either a soft manual or power toothbrush.
  - Fluoride toothpaste[10 Level III]
    - Toothpaste containing 1450 ppm F (twice daily) for children (over 6 years old) with caries risk.
- Dietary advice with regard to caries prevention.
- Fissure sealant and/or SDF (Silver diamante fluoride)

VI. MANAGEMENT OF MALOCCLUSION

KEY MESSAGE

Early prevention of malocclusion in mixed dentition is either to eliminate or reduce the severity of a developing malocclusion[1 Level II-2].

5.1. Monitoring

Many situations of apparent malocclusion in the mixed dentition are actually manifestation of the normal process of dental and facial development, also the minor incisor irregularities, spacing and ectopic eruption of teeth, which may show up during the mixed dentition, could self-correct with growth and development.

5.2. Management of habits/behavior and counseling

- **Habitual finger or thumb sucking[11 Level II-2]**

The child should be gently persuaded to stop the habit before 6 years old.

➢ Behavior therapy:

- Find out which finger/thumb that the child sucks and why he/she sucks. If the child is sucking due to anxiety or distress, address the cause(s).
- The patient should be shown models and photographs demonstrating the detrimental effects of thumb-sucking.
- Ask questions such as whether the child would suck his thumb in the midst of his/her friends? When is he going to stop sucking his/her thumb permanently? Tell the child, "You are not going to suck your thumb for the rest of your life so why don't you stop today?" And other methods to stop the child's habit:
    - An adhesive bandage may be taped to the offending finger as a reminder.
    - Use a reward chart as an incentive to help him stop sucking. Praise the child whenever he stops sucking his thumb.
    - Use a clean sock to cover the child's hand during the night.
    - Tying or pining a child's hand onto his pajamas.
    - Use a thumb/digit guard.
    - Place bad tasting compounds on the offending thumb.

Note:

- Habit is stopped at the right age, the dentoalveolar segment will grow to its normal position in the right occlusion.
- If the child stops thumb sucking before 7 years, the malocclusion will usually resolve spontaneously.

5.3. Management of early loss of deciduous teeth

One important role of primary teeth is to hold space for permanent successors. When a primary tooth is lost, it drifts into the lost primary tooth space (Appendix 6: Table 8). This drifting may diminish arch perimeter, create undesirable occlusal changes, and impact erupting permanent teeth.

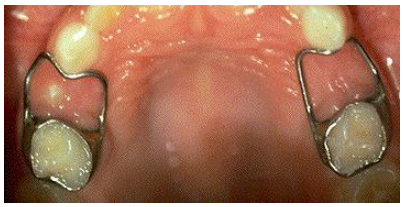
Space maintenance is the prevention drifting and/or prevent of arch perimeter loss (arch length loss) subsequent to primary tooth exfoliation (Figure 8). It is used for patients with mild-to-moderate crowding in the late mixed dentition.

KEY MESSAGE
Space maintainers:

- Indications
  - Where there is just sufficient room for all the permanent teeth, or
  - In severely crowded case, where the extraction of one permanent tooth from each quadrant will provide just enough space.
- Contraindication
  - For patient will spacing (where space loss will not occur anyway)
  - In moderate crowding (where extraction of permanent teeth and orthodontic treatment will be needed).

There are different types of space maintainer:

Band and loop

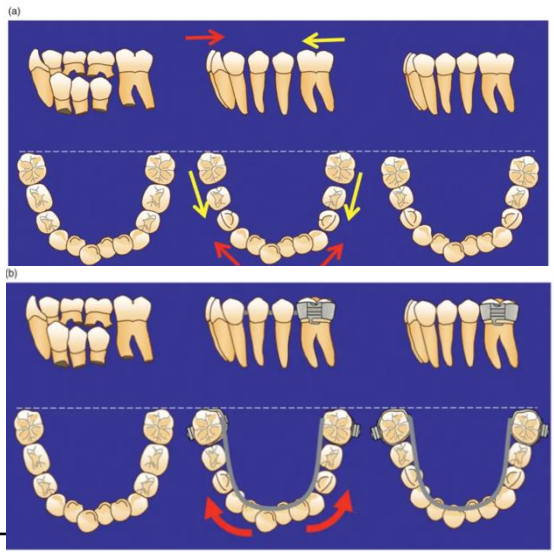


Distal shoes

Lower lingual holding arch

Figure 8: Transition between mixed and permanent dentitions.

(a) crowded mandibular arch without an LLHA. Note mesial molar drift with minimal improvement of mandibular anterior crowded.
(b) crowed mandibular arch with an LLHA in place. Note improved alignment of mandibular anterior teeth.



5.2.1. Management of dental crowding

Crowding is the most important factor for experts to decide on extraction treatment. It is caused by a faulty relationship between the jaw size, arch perimeter and tooth size. Chronologically, crowding may become manifested at 7 years of age on eruption of the incisors and 10 to 12 years on eruption of the canines, premolars and second molars (Appendix 6: Table 8). Type of crowding: Mild (1-3mm), Moderate (4-8mm), and severe (≥9mm).

KEY MESSAGE

Classification of crowding

1. **Hereditary:** tooth size-jaw size discrepancy (genetically the parent inherits small jaw from one parents and large teeth from another parent)
2. **Environmental**:

- Premature loss of primary teeth/trauma
- Unrestored proximal caries; teeth will tip and no space for perm teeth to erupt.
- deficiency in the arch length
- Prolonged retention of the primary teeth/ ankylosed primary teeth
- Altered eruption sequence/abnormal eruption path
- Transposition of teeth (teeth exchange position-mostly in the upper between lateral incisors and canines, in the lower between canines and first premolars)
- Discrepancy of tooth size
- Abnormal tooth shape

A. Monitoring (Recall)

Monitoring (recalling) patients with crowding in the primary/early mixed dentition. This is assuming that the permanent canine and premolar roots are immature (less than ½ developed) – that is, that the canines and premolars are not close to eruption. This is also assuming that you judge the potential harm from monitoring to be minimal (e.g., the probability of root resorption from ectopically erupting teeth to be minimal). Retained deciduous teeth need to follow up.

B. Extraction

Extraction with/without appliances: Check before extraction as following:

- the tooth prognosis,
- severity of crowding and availability of tooth alignment,
- permanent teeth that are present

There are types of extraction such as: Balancing and compensating deciduous tooth extractions, Timely extraction, Serial extraction, Extraction of deciduous canines, Extraction of first permanent molars. (Appendix 5: Table 7)

KEY MESSAGE

Early management of tooth size/arch size discrepancy

- Extraction of primary teeth to:
  - Maintain central lines (mostly the contralateral lower C or D is extracted)
  - Maintain the buccal relationships (by extracting the opposing tooth)
- Early extraction of C to correct the palatal displacement of 3 and allow its spontaneous eruption.
- Early extraction to relief crowding (removing the upper C to create space for the upper lateral incisors and prevent them from eruption in a crossbite)
- Using leeway space to relief crowding
- Using primate space to relief crowding
- Active expansion of the arches in the mixed dentition (only expand the upper arch- this method has high degree of relapse and needs long retention time)

Primate space = spaces mesial to the upper C and distal to the lower C

Leeway space = the difference in the MD width between CDE and 345 (CDE are wider than 345 (space is provided for the eruption of 345)

Leeway space = 1.8mm in the maxilla (0.9mm in each side)

3.4mm in the mandible (1.7mm in each side)

B.1. Balancing and compensating extractions

- Balancing extraction is the removal of the contralateral tooth - to avoid midline/ centerline shift (removal opposite side of the same dental arch).

- Compensating extraction is the removal of the equivalent opposing tooth (opposing quadrant) – to help maintain occlusal relationships between the arches.

B.2. Timely extraction (Appendix 3: Table 4-5)

Timely extraction is extraction of the teeth in order to relief crowding temporarily or to eliminate the source of deflection/ interference of eruption. (Figure 4)

Note:

- Extraction of supernumerary tooth that prevents the permanent tooth from eruption
- Extraction of retained deciduous teeth for the succeeding permanent teeth to erupt into alignment. (Figure 2)

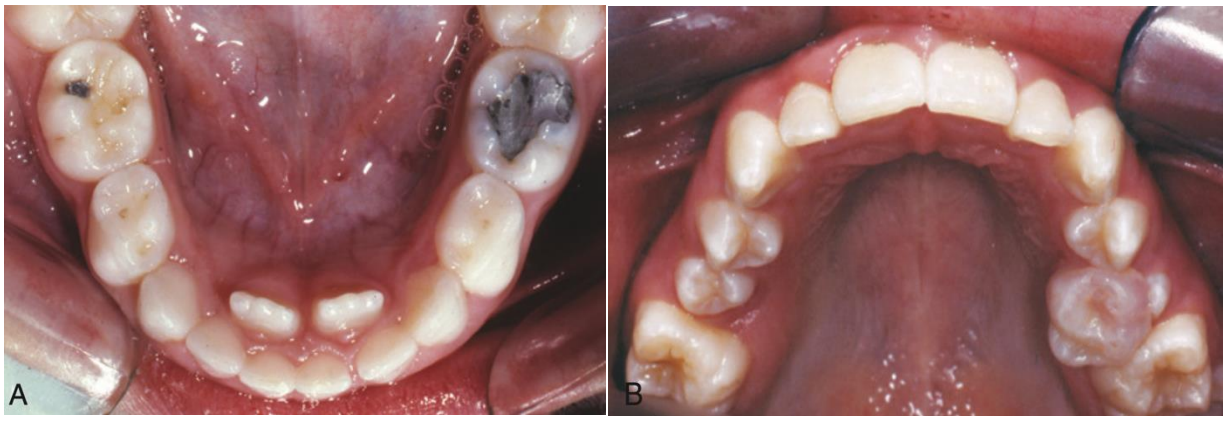


Figure 4. Permanent teeth erupted in abnormal positions as a result of retained primary teeth.
(A) #3, #41 erupted lingually because the primary teeth incisors have not been lost.
(B) #25 has been deflected facially because of the retained primary molar. In both the circumstance shown here, removal of the retained primary tooth or teeth will allow some spontaneous alignment[6 Level III].
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B.3. Extraction of intensively carious first permanent molars (FPM) (Appendix 5: Table 7).

- Effect of extraction of 6 at the optimal time: 7 erupts mesially and 5 erupts distally and there is usually fair contact between 5 &7.
- This will relieve crowding in the premolar & canine region and mild & moderate incisors crowding may improvement.

- Disking of deciduous teeth (Appendix 5: Table 7).

KEY MESSAGE

- **If 6 is removed before the age of 8 years old: Effect**
  - The unerupted 5 can drift distally and tip from its position below the apices of E.
  - The lower labial segment can retrocline, resulting in increased overbite.
- **If 6 is removed after 7 has erupted: Effect**
  - 7 will tip forward and rotate mesiolingually
  - Spacing or poor contact between 5 & 7 causing food impaction
  - Usually needs fixed appliance to achieve good contact.

Note: FPM treatment-planning decisions should ideally be made following input from both the general dental practitioner (GDP) or pediatric dentist and a specialist orthodontist.

B.4. Serial extraction (Appendix 4: Table 6)

- Serial extraction is the best treatment option, the extraction of all deciduous canines is prescribed, which will lead to a self-correction of the anterior crowding by tooth migration towards the extraction sites, reduction of bimaxillary protrusion, closure of an existing dental open bite and perhaps even to spontaneous correction of an anterior crossbite[8 Level II-3]. (Figure 5-6)
- The patient is only seen every six months for monitoring of tooth eruption[8 Level II-3].
  - Permanent mandibular canine tends to erupt prior to the mandibular first premolars, extraction of the mandibular first deciduous molars is advisable to speed up the eruption of the first premolars.
  - Once the maxillary and mandibular premolars have erupted, they will be immediately extracted and monitoring of further tooth eruption is continued until all permanent teeth, including the second molars, have erupted.

- The beauty of serial extraction treatment is that the nature eruption pathway can be utilized in order to reduce the active treatment time and to keep treatment as comfortable as possible[8 Level II-3]. (Figure 7)
- Critics of serial extraction treatment often state that early extraction of deciduous canines is a "one-way street" and conditions these patients to pursue the pathway of later premolar extractions[8 Level II-3].
- **Procedure consists of the three steps:**
  - Extraction of Cs as the permanent laterals are erupting in a crowded position
  - Extraction of Ds when its roots are 1⁄2 resorbed, to promote early eruption of 1st premolars (usually 6 to 12 months before Ds normal exfoliation, at the point when the underlying premolars have 1⁄2 to 2⁄3 of their roots formed)
  - Extraction of the permanent first premolars before eruption of the permanent canines

    Most of these patients still need some appliance therapy which will be shorter duration and simpler than if crowding had been allowed to develop before orthodontic intervention.

KEY MESSAGE

- Treatment stages in serial extraction:
  - First, the primary canines are removed to allow spontaneous alignment of the permanent incisors.
  - The primary first molars are moved to allow the eruption of the first premolars.
  - Once the first premolars are erupted, they are removed and space maintainer
- In the upper arch, if 5 being displaced palatally and provided 4 is in a satisfactory position, extract of 5 on eruption is advisable.
- In the lower arch, 5s are usually crowded lingually, extraction of lower 4 is easier and will give lower 5 space to upright spontaneously.

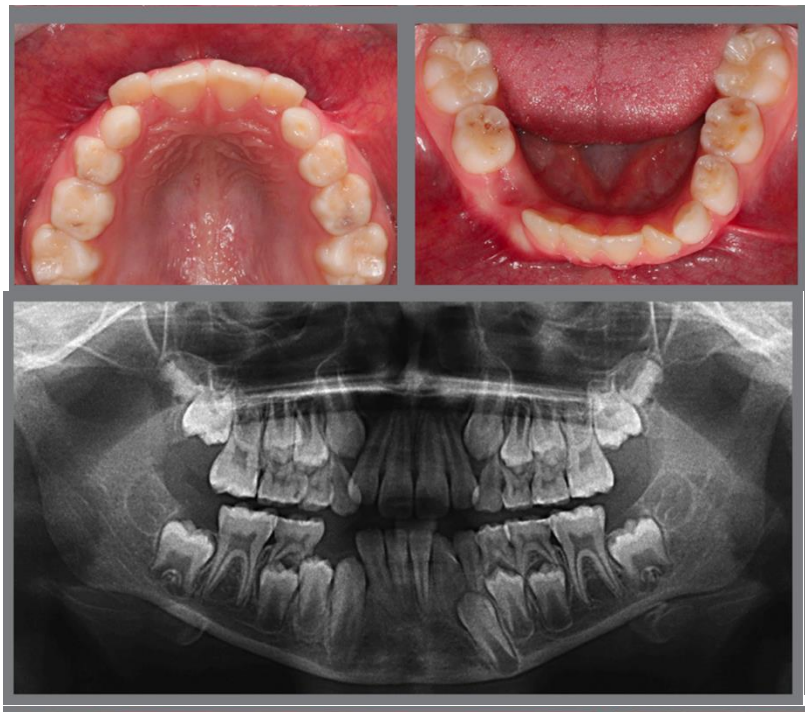


Figure 5: This 9-year-old patient presented a well-balanced profile, a class I hyperdivergent skeletal pattern and bimaxillary anterior and posterior crowding, with an anterior open bite and tendency for gingival recession in the mandibular incisor area [8 Level II-3].

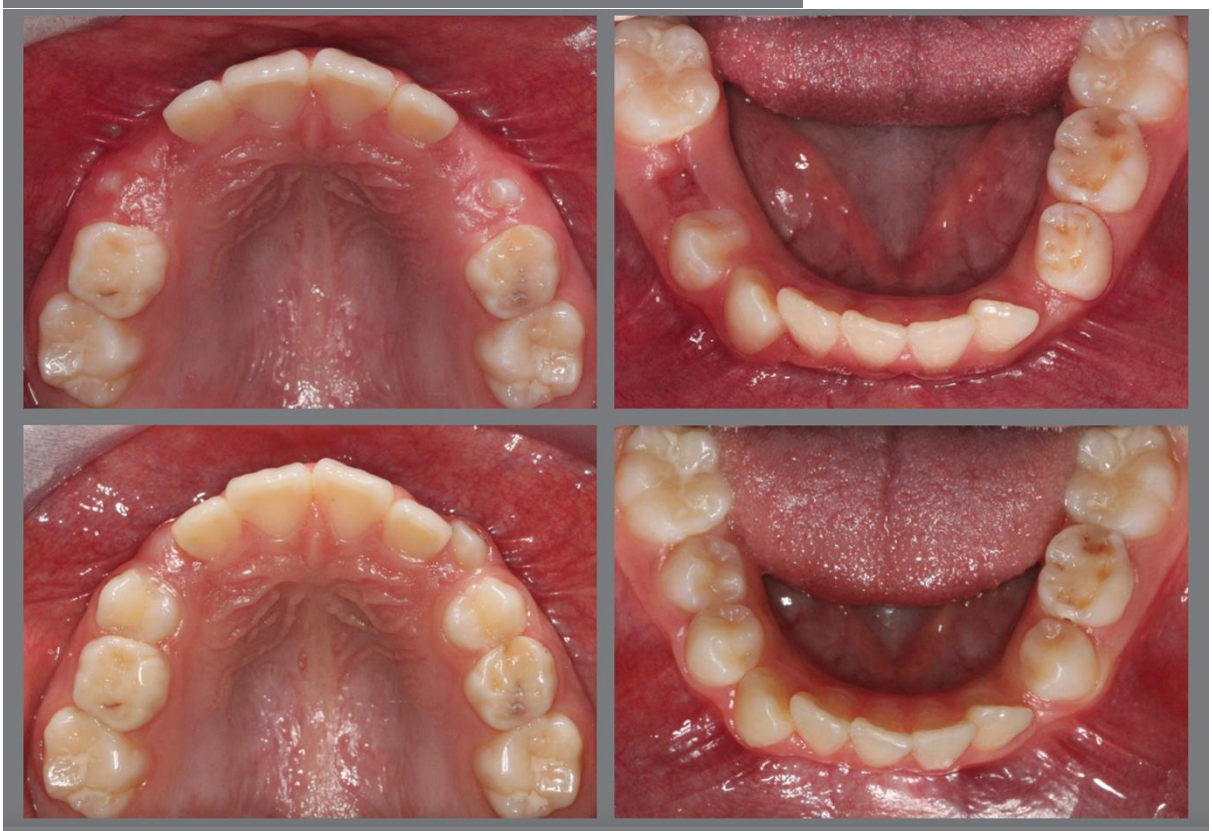


Figure 6: After extraction of all deciduous canines, eruption of the first premolars is monitored. The teeth are then immediately removed and after complete eruption of the second molars, the necessity for further treatment is re-evaluated [8 Level II-3].

Table 10: The Primary/Permanent teeth, Average mesiodistal widths (in millimeters)

	Primary Teeth	Sum of C, D, E	Permanent Teeth	Sum of 3,4,5
Maxillary				
Central Incisor	6.5mm		8.5mm	
Lateral Incisor	5.1mm		6.5mm	
Canine	7.0mm	**22.5 mm**	7.5mm	**21.5mm**
First Molar (first Premolar)	7.3mm		7.0mm	
Second Molar (second Premolar)	8.2mm		7.0mm	
First Molar			10.0mm	
Second Molar			9.0mm	
Mandibular				
Central Incisor	4.2mm		5.0mm	
Lateral Incisor	4.1mm		5.5mm	
Canine	5.0mm	**22.6mm**	7.0mm	**21.0mm**
First Molar (first Premolar)	7.7mm		7.0mm	
Second Molar (second Premolar)	9.9mm		7.0mm	
First Molar			11.0mm	
Second Molar			10.5mm	

Note:

1- Estimate the potential leeway space available in Maxillary and Mandibular arch

- Average maxillary leeway space = 22.5 mm - 21.5 mm = 1.0 mm per side of arch
- Average mandibular leeway space = 22.6 mm - 21.0 mm = 1.6 mm per side of arch

2- "E-space" is the difference in mesiodistal widths between primary second molars and their permanent successors (second premolar).

- Average "E-Space" of Maxillary = 8.2 mm – 7.0 mm = 1.2 mm per side
- Average "E-Space" of Mandibular = 9.9 mm – 7.0 mm = 2.9 mm per side

3- Children will often present with erupted permanent canines and erupted first premolars but unerupted second premolars in Figure 10. In these cases, leeway space in no longer valid, but "E-Space" can provide an estimate of future space available (for spontaneous incisor alignment if space maintenance is employed).

Figure10: mandibular arch model

4- "D-Space" is smaller than "E-Space", but for the mandible, it would equal 7.7mm – 7.0mm = 0.7 mm per side (the difference in mesiodistal widths between mandibular primary first molars and mandibular first premolars).

Example 1: Alignment of crowded mandibular anterior teeth with LLHA:

- Estimate of mandibular anterior crowding for the patient in Figure11 was 8.7 mm (Table 10).
- If we assume 2.9 mm of "E-Space" per side with an LLHA (5.8mm total), and 0.7mm "D-Space" per side (1.4 mm total), then upon complete emergence of mandibular and canines, the remaining anticipated crowding was 1.5mm, which is close to the actual ~3mm found.

- Note: leeway space, “E-Space”, “D-Space”, are based on average values. Every patient is different.

Table 10: Estimated anterior crowding

Contact: Figure 11	Estimated crowding (Space needed)
Since the left permanent canine is unerupted, we compare its anticipated mesiodistal width (7mm) with the 3.5 mm space currently present	3.5 mm
Left Lateral Incisor – Left Central Incisor	0.2 mm
Left Central Incisor – Right Central Incisor	1.5 mm
Right Central Incisor – Right Lateral Incisor	0.0 mm
Right Canine – since it is unerupted, we compare its anticipated mesiodistal width (7 mm) with the 3.5 mm space present	3.5 mm
Total estimated anterior crowding	8.7 mm

Figure 11: Mandibular anterior crowding in a mixed dentition patient.

Example 2:

Alignment of crowded mandibular anterior teeth with LLHA (moderate crowding):

- Premature loss of mandibular primary canines; in case, lateral incisor distal drift can be prevented by soldering spurs (clasps) to the LLHA to wrap around the distal of the lateral incisor in Figure3.

Note: that the right permanent canine is beginning to erupt and will be blocked out by the soldered spur. The left soldered spur will similarly block the left permanent canine in Figure

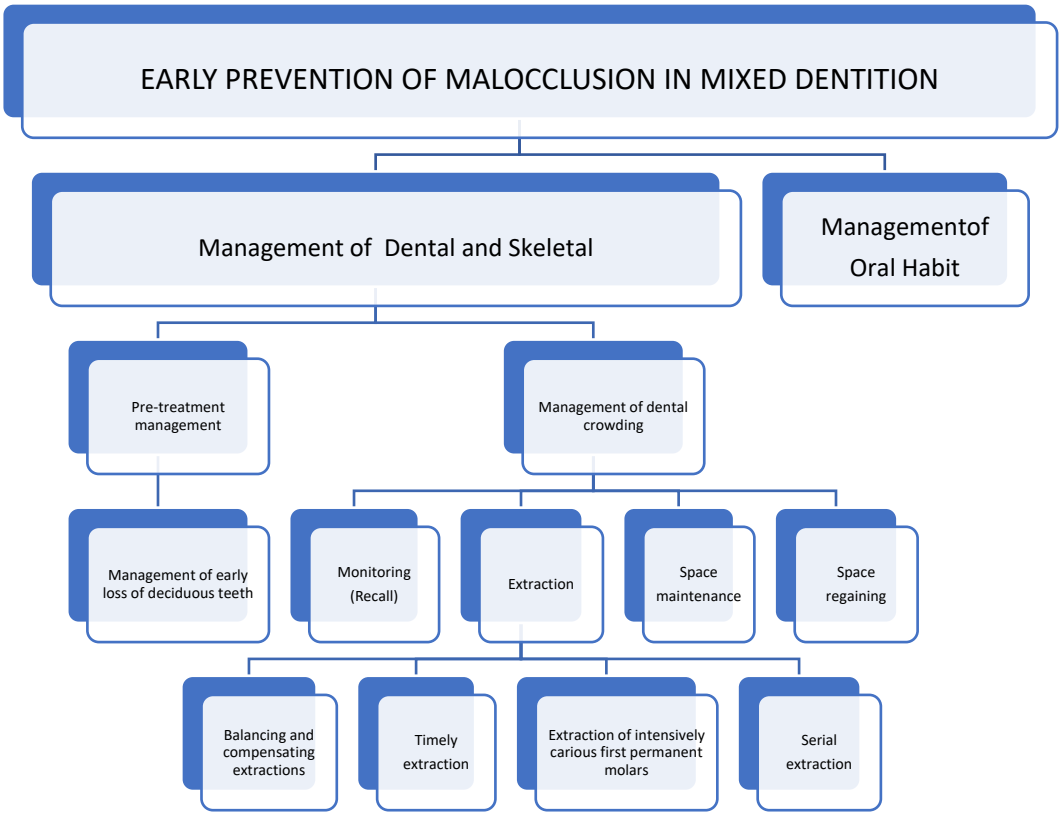
12. So remove the LLHA, grind away the spurs, and re-cement the LLHA, or, we should remake the LLHA without spurs.

Figure 12: LLHA with spurs to Prevent Distal incisor drift.

D. Space regaining

Space regaining is orthodontic tooth movement designed to reverse space loss resulting from tooth drift following premature primary tooth loss, tooth drift into extensive carious lesions of adjacent teeth; or ectopic tooth eruption. Techniques to regain space include the use of removable appliances, fixed appliance, or headgear.

V. ALGORITHM



VI. APPENDICES

Appendix 1

Table 1: Occlusal development may be divided into five stage[2] [Level III]:

Stage	Dentition	Event
Stage 1	Birth to establishment of deciduous dentition.	**At birth**: - The maxillary and mandibular gum pads have 20 segmented elevations corresponding to the unerupted deciduous teeth. - The upper arch is horseshoe-shaped and the vault of the palate is very shallow. - The lower arch is U-shaped and the gum pad on the anterior is slightly everted labially. - With the mandible in its physiological rest position the gum pads are parted, with the tongue filling the space between them and projecting against the lips anteriorly. - The maxillary gum pad overlaps the mandibular both buccally and labially, corresponding to the occlusal relationship of the teeth. **The deciduous dentition:** - Eruption of the lower incisors begins at about 6 months of age. - The timing of eruption may vary at a range of 6 months earlier or later compared to the time of eruption on the chart. - Usually by the age of 2 ½ years all the deciduous teeth have erupted. - The incisors are more vertical than their permanent successors and they are often spaced Lack of spacing

		strongly suggests that the permanent incisors will be crowded - There may be spacing distal to the lower canines and mesial to the upper canines (known as „primate spacings“) - The distal surfaces of the second deciduous molars usually end in line with each other - (termed the „flush terminal plane“) - By age 5-6 years, an edge-to-edge occlusion with incisor attrition is common.
Stage 2	Deciduous dentition to early mixed dentition	- Lower first molars or lower central incisors are usually the first to erupt- at the age of 6 years. Mild incisor crowding is common but tends to resolve by 9 years with an increase in intercanine width. - Eruption times of permanent teeth may vary at a range of 18 months earlier or later compared to the time of eruption on the chart. - Note: Teeth presence in early mixed dentition (at 6 to 8 years) are 6EDC21 12CDE6 6EDC21 12CDE6 **The permanent incisors** - The permanent incisors develop lingual/palatal to the roots of the deciduous incisors - Space for the permanent incisors teeth (which are larger than their deciduous predecessors) is provided by: • Utilization of existing spacing between the deciduous incisors. • A growth increase in intercanine width. This takes place during the eruption of the incisors. (The

		intercanine growth is mostly completed by 9 years with some minimal increase up to age 13 years. After this time a gradual decrease is the norm). o Upper inter-canine width increased by about 3.5 mm o Lower inter-canine width increased by about 3.0 mm - The upper permanent incisors are more proclined and thus form a larger arch than the deciduous incisors. Note: If the deciduous incisors root is not resorbed normally, the permanent incisors may be deflected lingually or labially or distally. When the upper incisors erupt they are frequently distally inclined so that there is a median diastema. This is the 'ugly duckling' stage. It is due to permanent canines migrate and press on the roots of permanent lateral incisors; causing their crowns & to a lesser extent those of permanent incisors to flare distally. When the permanent canines erupt the median diastema (physiological spacing) will usually close spontaneously. This is a natural developmental stage and treatment should not be undertaken to close the diastema before the permanent canines erupt. **The permanent first molars** - In a normal occlusal relationship the flush terminal plane of the second deciduous molars brings the first permanent molars into cusp-to-cusp contact (Fig. 2.10) - There is usually a small growth spurt associated with the eruption of the 1st permanent molars leading to an increase

		in face height, and in a growth in inter-canine width to accommodate the larger incisor teeth.
Stage 3	Early mixed dentition to late mixed dentition.	- about 9-10 years old - No permanent teeth erupt at this stage
Stage 4	Late mixed dentition to permanent dentition.	- ≥ 11 years old - The mandibular canines and maxillary first premolars are usually the first to erupt at this stage. - During this phase the remaining deciduous teeth (C, D, E) are shed and replaced by their permanent successors (3, 4, 5), and the 2nd & 3rd molars erupt. - Space for the permanent canines and the premolars (3, 4, 5s) is provided by slightly greater width of the deciduous canines and molars (C, D, Es). - The discrepancy between the combined mesiodistal width of the C, D, E and that of the 3,4,5 is called the 'leeway space'. - In normal occlusion, Class 1 molar relationship is established due to: • Greater leeway space in the mandible (about 2-2.5mm) than in the maxilla (about 1-1.5mm) allows the lower permanent molar to move forward further than the upper molar- when C, D, Es are replaced by 3,4,5s. • Forward growth of the mandible - The second upper permanent molars are guided directly into occlusion by the distal surface of the first permanent molars. - Growth posteriorly at the back of the arch provides space for the permanent molars.

		- Alveolar bone growth maintains occlusal contact as the face grows vertically.
Stage 5	Permanent dentition.	**Features of normal occlusion in the permanent dentition (**Static occlusal relations) - The mesiobuccal cusp of the upper first permanent occludes with the midbuccal groove of the lower first permanent molar. - The upper canine occludes in the embrasure between the lower canine and the lower first premolar. - The overjet is 2 to 3 mm. - There is complete overbite = 1/3 of the lower incisor clinical crown (20% to 30%) - The arches are regular in form. - All teeth must be present, are of normal form and in correct alignment. - There should be tight contact points between each of the teeth. **Andrew Six Keys** 1. Correct molar relationship: The distal surface of the distal marginal ridge of the upper 1st molar; occludes with the mesial surface of the mesial marginal ridge of the lower 2nd molar. The mesiobuccal cusp of the upper 1st molar occludes with the groove between the mesiobuccal & middle cusps of the lower 1st molars. 2. Correct crown angulation (tip) 3. Correct crown inclination (torque) 4. No rotations

		5. No spaces: tight contact points 6. Flat occlusal plane: Curve of Spee ≤ 1.5mm

Appendix 2

Table 2: An alternative way of categorizing etiology of malocclusiton[2] Level III

Hard Tissue	Soft Tissue
• **Dental** o Local: Tooth number/size/shape, ectopic eruption, early/delayed loss deciduous tooth. o General: Size of arch/tooth, extensive hypodontia or hyperdontia • **Skeletal** o Local: Alveolar insufficiency o General: Genetics (cranial base length, saddle angle) o Pathology: Excessive growth hormone o Head and Neck syndrome: Crouzon syndrome	• Local o Digit sucking o Lip habit o Tongue habit o Fraenum o Pathology (e.g. scarring) • General o Genetic o Lip morphology o Respiration (mouth breather) o Pathology (e.g. cleft lip)

Table 3: Summery of etiology of malocclusion [2] Level III

Etiology associations for intra-arch variation			
Intra-arch variation	**Dentoalveolar factors**	**Skeletal factors**	**Neuromuscular factors**

General crowding irregularities	Large teeth	Small jaw capacity	Restricted development of arch circumference
Local crowding irregularities	Premature extraction of deciduous teeth. Retained deciduous teeth; supernumerary teeth. Local variation in tooth size or shape.		
Impacted teeth	As for general and local crowding		
Ectopic teeth	As for general and local crowding. Trauma to deciduous predecessor.		
Late lower incisor crowding	Mesial migration of posterior teeth during vertical growth.	Late mandibular rotation.	Increased lower lip tone.
General spacing	Small teeth	Large jaw capacity	Large tongue; everted lips.
Local spacing	Tooth extraction, hypodontia, abnormal fraenal attachment; interrupted trans-septal fibre system; supernumerary teeth. Cysts, tumors.	Compensatory maxillary incisor proclination in Class III skeletal pattern.	Digit sucking.
Etiology associations for inter-arch variation			
Inter-arch variation	**Dentoaveolar factors**	**Skeletal factors**	**Neuromuscular factors**

Class II division 1 incisor relationship		Class II skeletal pattern	Digit sucking Lack of lower lip coverage
Class II division 2 incisor relationship	Underdeveloped incisal cingulae	Class II skeletal pattern (often mild). Decreased lower face height.	High lower lip line. Overclosure and undereruption of posterior teeth related to lack of interincisal contact.
Class III incisor relationship		Class II skeletal pattern.	Anterior forced bite from premature contact
Partial anterior crossbite	Lingual deflection of maxillary incisor, e.g. retained deciduous tooth, crowding.	Class III skeletal pattern (mild)	Anterior forced bite from premature contact
Bimaxillary proclination		Protrusive maxilla and mandible.	Large tongue, everted lips
Increased overbite		Skeletal relationships preventing interincisal contact (as in Class II divisions 1 and 2 and Class III incisal relationships; reduced lower face height	Overclosure and under- eruption of posterior teeth related to lack of interincisal contact
Anterior openbite		Increased lower face height	Digit sucking, obstructed nasal airway. Tongue position.

Centre line discrepancy	Asymmetry in the number of developed teeth or in the pattern of extractions.	Skeletal asymmetry	Lateral forced bite position from premature contact.
Class II molar relationship	Loss or absence of mesial teeth in maxilla	Class II skeletal pattern	
Class III molar relationship	Loss or absence of mesial teeth in mandible	Class III skeletal pattern	Anterior force bite
Posterior crossbite	Localized deflection of teeth e.g. retained deciduous tooth, crowding	Discrepancy in maxillomandibular width	Lateral forced bite (in unilateral crossbite)
Lateral open bite	Localized failure of eruption	Increased curve of Spee as compensation for Class III skeletal pattern.	Tongue position

KEY MESSAGE

Etiology of malocclusion

1. Skeletal problems: Anterio-posterior (mostly genetic)
   - Class II is caused by mandibular deficiency: mild to moderated class II (mostly inherited) and severe class II (mostly inherited + environment factors)
   - Class III is caused by maxillary deficiency or mandibular prognathism (mostly genetic); mandibular prognathism has racial and familial tendencies.

2. Skeletal problems: Vertical/ Transvere (mostly inherited, but environment factors can contribute)
   - Crowding genetic factors: the child inherits the jaw size from one parent and tooth size from another parent (small jaw and big teeth)
   - Crowding environmental factors:
     - Early loss of primary teeth
     - Digit sucking
     - Softer less abrasive diet (less interproximal tooth wear, less demands on the jaw function and general tendency for smaller jaws)

Appendix 3

Table 4:Typical age of eruption, mesiodistal widths and calcification of primary teeth[2] Level III

	Time of eruption (months)	Mesiodistal width (mm)	Calcification commences (weeks in utero)
Maxillary teeth			
Central incisor (A)	8	6.5	12-16
Lateral incisor (B)	9	5	13-16
Canine (C)	18	6.5	15-18
First molar (D)	14	7	14-17
Second molar (E)	24	8.5	16-23
Mandibular teeth			
Central incisor (A)	6	4	12-16
Lateral incisor (B)	7	4.5	13-16
Canine (C)	16	5.5	15-18
First molar (D)	12	8	14-17
Second molar (E)	20	9.5	16-23

Notes1:

- Eruption times vary considerably - up to 6 months earlier or later than the times given is not unusual.
- Mesiodistal widths vary up to 20 % of the figures given.
- Root formation is complete between 12 to 18 months after eruption.
- There is usually a difference of a few weeks between tooth eruption on the left and right sides.
- Usually the lower teeth erupt ahead of their upper counterpart.
- Calcification of first permanent molars begins at birth

Notes2:

- Timely extraction: relief crowding temporarily or to eliminate the source of deflection/interference of eruption

Table 5: Typical age of eruption, mesiodistal widths and calcification of permanent teeth[2]

Level III

	Time of eruption (years)	Mesiodistal width (mm)	Calcification commences (months)
Maxillary teeth			
Central incisor (1)	7.5	8.5	3-4
Lateral incisor (2)	8.5	6.5	10-12
Canine (3)	11.5	8	4-5
Fist premolar (4)	10	7	18-21
Second premolar (5)	11	6.5	24-27
First molar (6)	6	10	Around birth
Second molar (7)	12	9.5	30-36
Mandibular teeth			
Central incisor (1)	6.5	5.5	3-4
Lateral incisor (2)	7.5	6	3-4
Canine (3)	10	7	4-5
Fist premolar (4)	10.5	7	21-24
Second premolar (5)	11	7	27-30
First molar (6)	6	11	Around birth
Second molar (7)	12	10.5	30-36

Notes:

- The figures given both for the eruption times and for mesiodistal widths commonly vary up to 20% on either side of the figure given.
- The permanent teeth usually erupt when 3⁄4 of their roots are formed.
- Root formation is normally completed 2-3 years after eruption.

Appendix 4

Table 6: Summary serial extraction[2] Level III

Serial Extraction	
	• It was first advocated in 1948 as a solution to a shortage of orthodontists. • It involves the timed extraction of deciduous, and ultimately, permanent teeth to relieve severe crowding.
Indication	• Patient age 8-9 years and the incisors substantially crowded. • Skeletal Class I arch relationship. • Overbite normal or reduced. • All permanent teeth are present in good positions. • The first permanent molars have a good prognosis. • The first premolars should be closer to eruption than the canines. • Class I molar relationship. • Large arch perimeter deficiency (10mm or more) - severe crowding.
Contraindication	• Skeletal Class II or skeletal III jaw relationships • Face is unduly long or short (where a tight lower lip would retrocline lower incisors) • Facial profile is substantially concave
Procedure consists of the three steps	• Extraction of Cs as the permanent laterals are erupting in a crowded positions • Extraction of Ds when its roots are 1⁄2 resorbed, to promote early eruption of 1st premolars (usually 6 to 12 months before Ds normal exfoliation, at the point when the underlying premolars have 1⁄2 to 2⁄3 of their roots formed)

	• Extraction of the permanent first premolars before eruption of the permanent canines Most of these patients still need some appliance therapy which will be shorter duration and simpler than if crowding had been allowed to develop before orthodontic intervention.
Disadvantage	It involves putting the child through several sequences of extractions

Appendix 5

Table 7: Summary extraction of deciduous canines, first permanent molars and Disking of deciduous teeth[2] Level III

Extractions of deciduous canines (C)	
	• Timely extractions of Cs may avoid more complicated treatment in the future.
Indication	• Lateral incisors erupting into a crowded upper arch in Class I malocclusion. • In a crowded lower labial segment one incisor may be pushed through the labial plate of bone, resulting in a compromised labial periodontal attachment. • Extraction of lower Cs in Class III malocclusion can be advantages as it allows lower incisors to move/tip lingually. • To provide space for appliance therapy in the upper arch, e.g. correction of an instanding lateral incisors. • To improve the position of a displaced permanent canine. (**See: Management of early loss of deciduous teeth** (page 4)
Extraction of first permanent molars (D)	

	• First permanent molar extraction is done when the prognosis of the teeth is poor.
Indications for elective extraction all 4 permanent first molar	• The child should be aged 9-10 years (lower second molar bifurcation beginning to form, angle between long axis of 6 & crypts of 7 is 15-30°) • Class I malocclusion. • Mild or moderate crowding • The overbite is normal or reduced. • All the permanent teeth should be present. • The 1st permanent molars are carious. • The unerupted lower second premolar should not be distally inclined or spaced from the first premolar or outside the control of the E roots. **Note:** • If the first permanent molar is removed too early (before 8 years old), there is a tendency for the second premolar to erupt distally and become impacted against the second molar. • Extraction of upper 6s should be delayed until the 7s erupt when it is intended that the extraction space be used to treat an increased overjet or crowded upper incisors. • If a lower 6 must be extracted, the opposing 6 should be extracted (compensatory extraction) in mildly crowded Class I cases. This is to prevent over-eruption of upper 6 following extraction of lower 6. Over-eruption of upper 6 can lead to premature contacts and impaired closure of lower extraction space. • If an upper 6 must be extracted, no need to do compensatory extraction of lower 6 as less tendency for lower 6 to over-erupt in a Class 1 malocclusion.
Disking of deciduous teeth	

•	• Disking of deciduous teeth is indicated when there is mild crowding /impaction Example: disking of C → to align the irregular permanent incisors

KEY MESSAGE

Treatment planning for the loss of 6 (first permanent molar):

- **Class I Malocclusion:**
  - In minimal incisor or moderate premolar crowding: aim for extraction at the optimal time for good spontaneous eruption of 7, relief of crowding and spontaneous space closure.
  - In moderate severe crowding (especially in the incisor regions): either delay extraction until 7s have erupted and use the extraction space for tooth alignment with fixed appliance; or extract at optimal time for spontaneous space closure and treat the crowding once the permanent dentition is established. However, if premolar extractions (in addition to the extraction of 6s) are likely to be required, 8s should be present and of good morphology.
- **In Class II Division 1 Malocclusion**
  - Space will be required to relieve crowding and to reduce overjet. Timing of 6s extraction is important because of the need for overjet reduction.
  - Extract 6s after 7s have erupted and use the space for overjet reduction with fixed appliances.
  - Extract 6s at the optimal time and correct sagittal discrepancy early with functional appliance, or with a removal appliance and headgear. Fixed appliance can then be used to detail the occlusion.
- **In Class II division 2 Malocclusion**
  - Requirements are similar to those for a Class 2 division 1, space being required to relieve crowding and correct the incisor relationship.
  - However, overbite reduction can be difficult if large extraction spaces need to be closed in the mandibular arch and these should be avoided. If lower 6s need to be extracted this should be done at the optimal time to avoid spacing associated with the erupted lower 7s, even if this may result in some worsening of the overbite.
- **In Class III Malocclusion**
  - Extract 6s after 7s have erupted so that space can be used to relieve the crowding in maxillary arch and for incisor retraction in the mandible.

Table 8: Risk of early loss of primary teeth

- A,B : Generally, no effect on the development of occlusion, except in very severe crowding cases. If deciduous incisor is intruded by a blow/ fall, displacement or dilacerations of the successor may occur.
  Note:
  - Extract A, B before 1, 2 reaches the occlusal level. 1, 2 will move to the normal position.
  - If 1, 2 are already palatally erupted and there is an anterior crossbite,
    - Treat with removable appliance with Z-spring, or
    - Use a wooden spatula or ice-cream stick to prop the tooth to the front. Ask patient to bite on the spatula for 10-15 minutes, 3 to 6 times a day for 2 to 3 weeks, or
    - Use a lower inclined plane

- C : - Early loss of C (particularly in lower arch), might be due to the result of resorption of its root by a crowded permanent lateral incisor. Unilateral loss causes midline shift to the side of loss/extraction.
  - In cases where there is a nearly loss of C on one side, do balancing extraction on the opposite side of C in the same arch to prevent midline shift. (Figure 3)

  Note:
  - May need to put a lingual arch for the lower arch to prevent lower incisors from tilting lingually (causing further loss of space and deepening OB), especially if patient has active lower lip muscular activity.
  - If C retained, it may be a sign that 3 (permanent canine) may be in a ectopic position.
    - Palpate buccally and palatally to locate whether 3 is present from 9 years.
    - If 3 is not palpable in the buccal sulcus, its position should be investigated radiographically.
    - The C should be removed if 3 is found to be palatally placed.
    - If the unerupted palatal 3 overlaps less than half of the breath of the root of lateral incisor, 91% of it will normalized if C is extracted by age of 10-13 years.

Figure 3. This is patient lost two primary canines during the eruption of the permanent lower incisors. This usually indicates either a large incisor liability or a substantial shortage of lower arch perimeter[6 Level III].

- D : Early loss of D will result in loss of space for the premolars, partly through forward drift of E and partly as a result of relieve of incisors crowding. Unilateral loss may cause midline shift to the side of loss/extraction. Observe the midline. If there is midline shift, extract the opposite D on the same arch.

  Note: Unilateral loss of D:
  - May result in centerline shift, in most cases an automatic balancing extraction is not necessary, but centerline should be kept observed.
  - If there is centerline shift, extract D on the opposite side of the same arch (balancing extraction).

- E : If E is extracted the 6 will drift mesially and encroach on the space for premolars. There will be loss of space in the arch for the premolars to erupt.

  Space loss is usually more severe in the upper arch & if E is lost before 6 erupts.

  Therefore, try to preserve E until 6 has erupted. Unless the extraction is very early, loss of E has little effect on the midline so that balancing and compensating extraction are rarely necessary.

  Note: Loss of E:
  - Balancing and compensating extraction are usually not necessary
  - Space maintainer might be used if preservation of space for a permanent successor will avoid or simplify subsequent orthodontic treatment.

  Note: (D, E)

  D, E may be retained due to congenitally missing successors.
  - If the prognosis of the tooth is good, keep the tooth. Observe the teeth in case they submerge.
  - If the successors are present, the retained D, E will cause the eruption of 4, 5 to be deflected or impacted.
  - D, E early loss, D+E space on the extraction side was significantly smaller than the space un-extraction side[4 Level II-2].
  - D, E early loss, the thirst molar to move to the front of the mouth into the space left by the Leeway [5 Level I].

Look for the early signs of malocclusion		Worry about distal surfaces of Es in vertical line
Expect crowded permanent incisors if no spaces exist		
Discourage habits.		
Treat abnormal closure path or displacement		
Encourage caries prevention	7-9 yrs	Worry about “ugly duckling” stage.
Investigate delayed eruption		Worry about slight anterior open bite.
Refer Skeletal Class III to orthodontist		
Observe or use Leeway space in minimal crowding		
crowding is greater, consider serial extraction or extraction of 6s if carious/ poor prognosis		
Maintain space if appropriate		
Extract retained deciduous & supernumerary teeth that cause malocclusion		
Strongly discourage habits		
Observe or treat impacted upper 6s		
Consider extraction of transposed teeth.		
Treat incisors in anterior crossbites		
Treat pathology early		
Palpate canines starting from 9 years old extract upper Cs when 3s are ectopically placed.		

Watch for crowding & consider extraction of 4s or 7s	11-12 yrs	Worry about buccal segment crowding if deciduous canine & molars are still present
Extract deciduous teeth deflecting permanent successors		Worry about rotated premolars when they first erupt
Excise very large fraena where there is an upper midline diastema		Worry about minor submergence of deciduous molars
Strongly discourage habits.		
Extract upper Cs when 3s are ectopically placed		
Treat incisors in lingual occlusion urgently		
Consider Functional appliance for Skeletal Class II		

Adopted from Interceptive Orthodontics by Andrew Richardson

Appendix 7

Table 9: Summary examination oral habits[5] Level I

Type of oral habit present	Information collected via the question	Information collected via clinical exam
Mouth breathing	• Condition of lips closed while sleeping • Condition of lips closed while awake • Nose/mouth breathing habits	• Inspection of the nose and breathing conditions • In the resting position and when compelled to close, evaluate the lips and the condition of lip closure • The baby's mouth obscures the mirror surface during the mirror test
Tongue thrusting	• Tendency to protrude the tongue • During sleep or upon awakening, the habit involves positioning the tongue laterally between the two dental arches	• Inspect the tongue and its location (at rest) • Conduct a thorough examination of the tongue and perform a salivary swallow test
One side chewing	• Tendency to masticate on either one or both sides	• Tartar is concentrated on one side
Thumb sucking	• Thumb-sucking habit	• Finger examination
Lip biting	• Oral fixation of sucking or biting the lips	• Oral examination (marks made by teeth on the lips)
Check biting	• Analysis of the mucous membrane of the cheek	• Analysis of the mucous membrane of the cheek
Pen/pencil/nail biting	• Pen/pencil/ nail biting habit	• Examination of nail
Grinding of teeth	• Interview question for parents on children's nighttime	

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