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The Caries Management System: an evidence-based preventive strategy for dental practitioners. Application for adults

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ABSTRACT

In the absence of effective caries preventive methods, operative care became established as the means for caries control in general practice. Water fluoridation resulted in a declining caries incidence which decreased further following the advent of fluoridated toothpaste. The challenge today is to develop a non-invasive model of practice that will sustain a low level of primary caries experience in the younger generation and reduce risk of caries experience in the older generations.

The Caries Management System is a ten step non-invasive strategy to arrest and remineralize early lesions. The governing principle of this system is that caries management must include consideration of the patient at risk, the status of each lesion, patient management, clinical management and monitoring. Both dental caries risk and treatment are managed according to a set of protocols that are applied at various steps throughout patient consultation and treatment.

The anticipated outcome of implementing the Caries Management System in general dental practice is reduction in caries incidence and increased patient satisfaction. Since the attainment and maintenance of oral health is determined mainly by controlling both caries and periodontal disease, the implementation of the Caries Management System in general practice will promote both outcomes.

Key words: Dental caries, risk, non-invasive management, fluoride, evidence-based care.

Abbreviations and acronyms: CPP-ACP = casein phosphopeptide-amorphous calcium phosphate; DEJ = dentino-enamel junction.

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INTRODUCTION

The principles of modern operative dental care were established by GV Black one century ago, long before it became evident that dental caries could be arrested or prevented. In the absence of effective preventive strategies and with an increasing incidence of caries in industrialized countries, the operative model of care became firmly established as the 'ideal' means of dental practice. On the other hand, the concept of preventive dentistry which was developed in the early 1970s has not been included in the dental psyche despite the overwhelming evidence of its value.[1] Operative care has remained the central management strategy for caries control in general practice.

Need for new directions

The introduction of water fluoridation resulted in a declining caries incidence which decreased further following the advent of fluoridated toothpaste. The dentate population now, in many countries including Australia, is a mix of those who did not benefit from water fluoridation during their early years and as a result have many restored teeth in need of lifelong maintenance, and those who did benefit and are either clinically caries-free or have few restored teeth. In addition, there are in both groups, those who are more at risk of caries than others. The challenge today in relation to these caries risk groups is to develop a model of practice that will: (a) sustain a low level of primary caries experience in the younger generation; and (b) prevent primary and secondary caries experience in the older generations.

Diagnosis and intervention

In 1972, Rugg-Gunn reported little association between the depth of a radiolucency and the clinical status of the tooth surface (whether or not it was sound, had an

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extensive white spot, or was cavitated).[2] In this study of English children, about 50 per cent of the bitewing radiolucencies that extended to the dentino-enamel junction (DEJ), but not beyond, were associated with cavities, yet 50 per cent were not. A decade later in Denmark, Bille and Thylstrup found among adolescents that cavities were associated with only around 20 per cent of radiolucences that extended to the DEJ and only 50 per cent of radiolucencies that were confined to the outer half of dentine.[3]

Hence the dilemma; what sign at a particular point in time indicates whether an approximal surface is cavitated and in need of a restoration, or has a progressive lesion that cannot be arrested, or could be arrested, or in fact, is already arrested? The Caries Management System offers a structured evidence-based strategy to address this problem.

THE CARIES MANAGEMENT SYSTEM

The Caries Management System is a ten step non-invasive strategy to arrest and remineralize early lesions (Table 1). This system was developed for use by general practitioners according to a new Caries Management Policy that had been adopted by the Faculty of Dentistry, University of Sydney, where learning and teaching within the new curriculum was designed to be informed by evidence-based practice.[4]

The governing principle of the Caries Management System is that caries management must include consideration of: (a) the patient at risk; (b) the status of each lesion; (c) patient management; (d) clinical management; and (e) monitoring.

Table 1. Ten step summary of the Caries Management System

Ten steps of the Caries Management System	
1	Diet assessment
2	Plaque assessment
3	Bitewing radiographic survey
4	Diagnosis and caries risk assessment
5	Preparation of treatment plan
6	Case presentation at which patient is informed about: • Dental caries: ○ Arrest ○ Reversal/natural repair (remineralisation) ○ Prevention ○ Number and status of current lesions ○ Role of dental practitioner in caries management ○ Role of home care in caries prevention ○ Current caries risk status • Result of diet assessment and recommendations
7	Oral hygiene coaching
8	Topical fluoride application (both professional and home care)
9	Monitoring of plaque control and treatment outcomes at each visit
10	Recall program tailored to caries risk status

Both dental caries risk and dental caries treatment are managed according to a set of protocols which refer only to those interventions that are well supported by a strong evidence base. The protocols are applied at various steps throughout patient consultation and treatment, and have a twin focus on the primary prevention of caries and its secondary prevention (arrest and reversal of early lesions) through non-invasive measures. The system is not concerned directly with the management of cavitated or symptomatic lesions other than recognizing their need for operative care. Moreover, it is not concerned with the management of patients suffering acute rampant caries due to extreme salivary insufficiency.

The patient at risk of caries

The case history and clinical examination provides an overview of unfavourable exposures to potential caries risk factors, namely: sucrose intake, fluoride use, dental plaque, tooth morphology, and salivary characteristics.

Diet assessment

One of the main risk factors for caries is frequent exposure to refined dietary sugar. However, this risk appears to have diminished in the face of better plaque control and better fluoride exposure in recent times.[5] As part of the dental history, a Usual 24-hour Diet Questionnaire is completed (Table 2). A thorough analysis of the frequency of consumption of between-meal sugar-containing snacks and beverages will give an insight into the burden of diet-related caries risk.

Table 2. Diet information obtained using the Usual 24 hour Snacking Questionnaire

Content of the *Usual 24 hour Snacking Questionnaire*	
Five questions are asked.	
Do you usually have anything to eat or drink:	
1	as soon as you get up in the morning before breakfast?
2	between breakfast and lunch?
3	between lunch and dinner?
4	after dinner?
5	just before you go to bed or during the night?
In relation to ***yes*** answers, the type and frequency of each sugar-containing food and beverage (shown on the lists below) that is consumed on that occasion is recorded. The number of spoons of sugar added to hot beverages is also recorded.	
Biscuit Cake Pastry Chocolates, lollies Other sweet food	Fruit juice Cordial Fizzy drinks (coke, lemonade, etc) Tea Coffee Other hot drink

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Assessment of dental plaque control

Visible plaque indicates that the toothbrush, carrying the toothpaste, has not reached that part of the mouth recently to disrupt the biofilm. For caries control, the concentration of fluoride in the plaque fluid, at susceptible sites, is all important.

At the initial clinical examination and at every appointment thereafter, dental plaque distribution is recorded according to the Plaque Index on a special form that allows for multiple dated entries which is part of the Caries Management System pack (Fig 1).[6] The scores represent both increasing plaque thickness which is a surrogate for its age and its maturity. It is equally acceptable to record, instead, scores that relate to gingivitis or bleeding on gentle probing. Twelve sites are assessed: the buccal and lingual surfaces of the first permanent molars (8 sites) and the buccal and lingual surfaces of the upper and lower right permanent incisors (4 sites). The site on the buccal and lingual surfaces of each tooth to be assessed is the area adjacent to the gingival margin, extending from papilla to papilla. Individual surface scores are summed to give the patient a score which has a maximum value of 36.

Saliva assessment

The quantity (mL/min) of stimulated whole saliva produced in two minutes by chewing paraffin wax is measured. If the quantity collected during this time is less than 1 mL, and the caries risk is assessed as high risk (see below), then further investigation of hyposalivation is required. Otherwise, extreme reduction in salivary flow is very rare, and other salivary characteristics, though easily measured, are very poorly associated with caries incidence.[7,8] There seems little point in profiling these characteristics, at great expense, when no meaningful action can be taken to alter them.

The status of each lesion

Final assessment of the patient at risk follows completion of the clinical examination bitewing radiographic survey.

Clinical examination

Smooth surfaces and fissures are dried and explored with sharp eyes and a blunt probe to reveal incipient lesions and enamel breaks. These are recorded on standard dental charts. Unless frank cavitation is evident, the diagnosis of dentine caries is via a radiographic bitewing survey.

Bitewing radiographic survey

Radiolucencies are scored according to the five category system proposed by Mejare (Table 3).[9] These results are entered on a form that also allows for multiple dated entries so that radiographic changes can be followed serially (Fig 2) (Dennison PJ, written communication, April 2003). The purpose of this form is to aid monitoring of non-invasive management of early non-restored occlusal and approximal lesions. There is provision for recording the radiographic status of distal, occlusal and mesial surfaces of posterior teeth. For each surface, there is a column of boxes numbered 1 to 5 corresponding to a lesion score. Radiolucencies associated with already restored occlusal and approximal surfaces (i.e., secondary caries) are not recorded on this form.

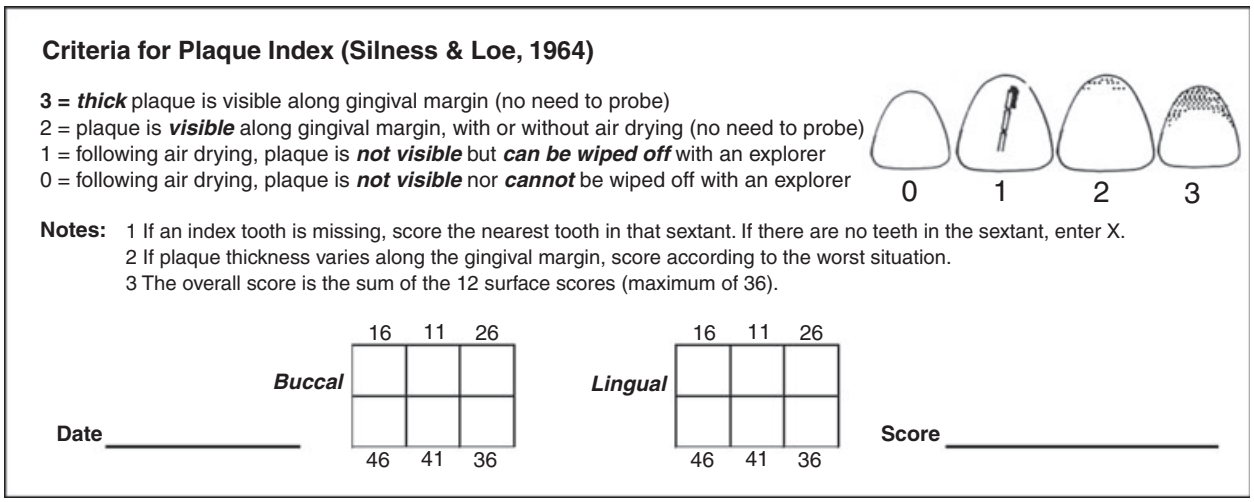

Fig 1. Criteria and instructions for reporting the Plaque Index scores, and one panel of recording boxes for the scores. (Note: There are 13 panels of boxes on an A4 sized form.)

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Table 3. Criteria for scoring bitewing radiolucencies on occlusal and approximal surfaces (after Mejare, 1999)

Criteria for Bitewing Radiolucency Scores	
C0	No radiolucency evident (not recorded)
C1	Radiolucency is evident within the ***outer half*** of enamel
C2	Radiolucency extends to the ***inner half*** of enamel and may reach the DEJ
C3	Radiolucency extends ***just beyond*** the DEJ
C4	Radiolucency is evident within the ***outer third*** of dentine
C5	Radiolucency extends to the ***inner two thirds*** of dentine and may reach the pulp

Table 4. Criteria for assigning caries risk status

Criteria for Caries Risk Status		
Caries Risk	New patient	Recall patient
Low	1. No clinical signs of caries 2. May have bitewing radiolucencies not greater than C3	1. <1 new lesion per year 2. Or no progression of existing radiolucencies
Medium	1. No frank cavitation 2. May have sticky pits or fissures 3. And/or bitewing radiolucencies not greater than C4	1. 1 new lesion per year 2. And/or progression of existing radiolucencies
High	1. Untreated frank cavities 2. And/or extensive white spot lesions 3. And/or C5 bitewing radiolucencies	1. >1 new lesion per year

Assessment of the patient's caries risk status

Following the clinical examination and bitewing survey, the caries risk status of the patient is determined pragmatically. Risk of caries, according to the Caries Management System, is determined at the first visit solely according to the clinical presentation of the dentition (Table 4). At later follow-up appointments, risk is determined according to the incidence rate of new lesions and progression status of existing lesions.

Patient management

The management of the patient at risk entails obtaining cooperation to implement protocols that will deliver a package of non-invasive measures designed to arrest active non-cavitated lesions and, once arrested, to maintain them in that condition.

Case presentation and treatment planning

The caries findings are presented to the patient in a case presentation and this is aided by reference to a Tooth Decay information leaflet (Fig 3). The front side of this leaflet contains essential information regarding caries (that the decay process involves demineralization and remineralization, or natural repair, and that home care is the key to oral health) while other important information is contained on the reverse side. The leaflet avoids dental terminology, instead utilizing words and phrases familiar to the Sydney population. This leaflet serves as the principle patient educational material for dental caries and provides a basis for obtaining informed consent from patients regarding the treatment plan. On this leaflet, the number of tooth surfaces showing bitewing radiolucencies of varying depth is entered as appropriate. Alongside is an explanation of the diagnosis and related treatment need. The prime

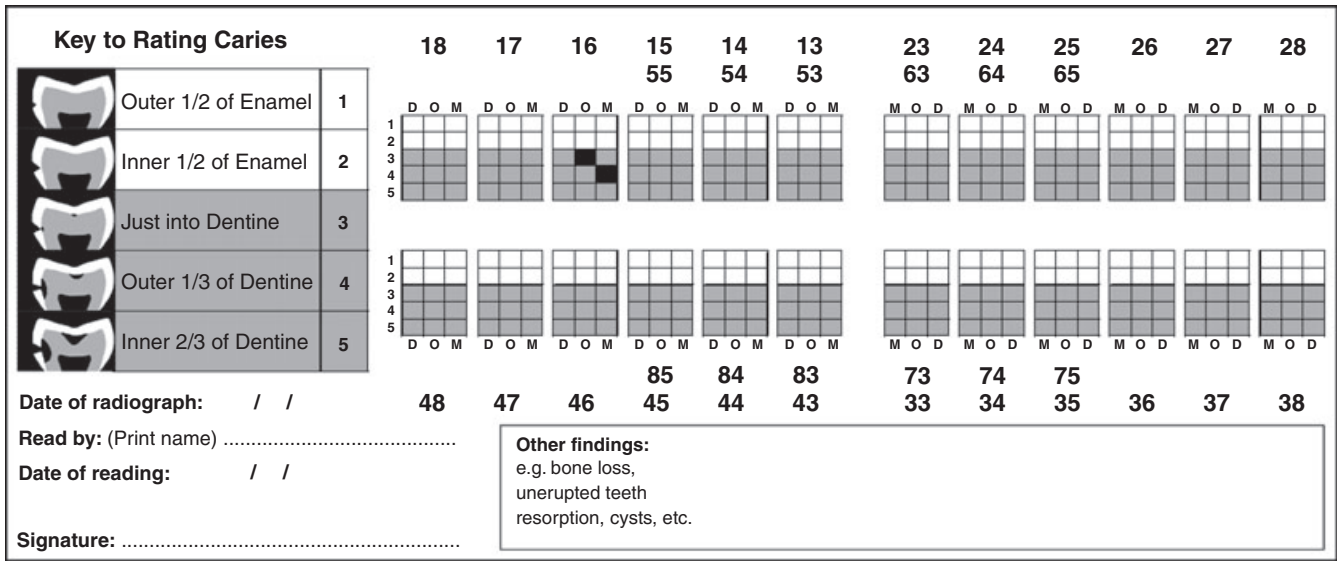

Fig 2. One panel of boxes on the Bitewing radiographic assessment form for recording bitewing findings. In this example, tooth 16 has a grade 4 radiolucency on the mesial surface and a grade 3 radiolucency on the occlusal surface. (Note: There are 3 such panels on an A4 sized form.)

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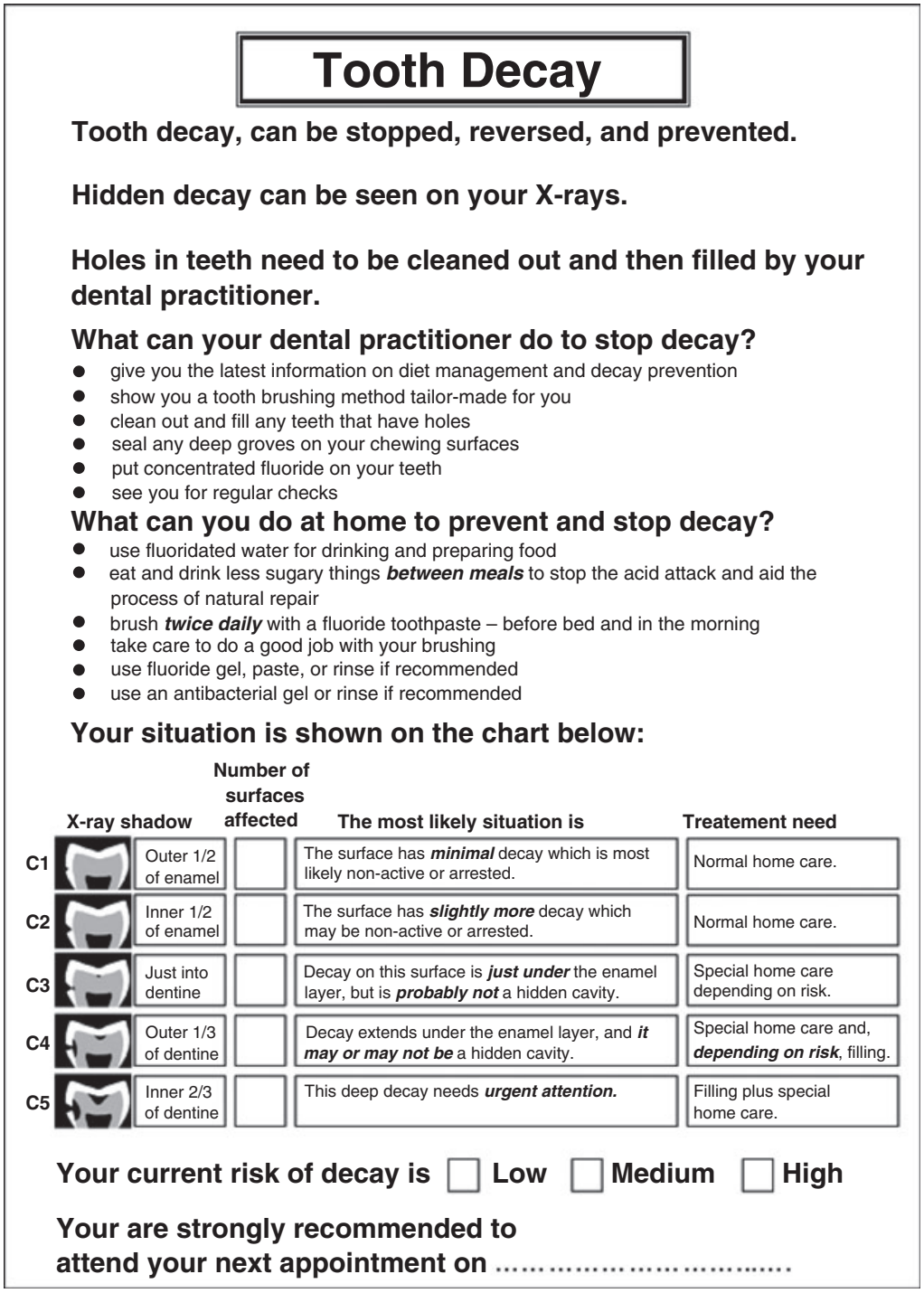

Tooth Decay

Tooth decay, can be stopped, reversed, and prevented.

Hidden decay can be seen on your X-rays.

Holes in teeth need to be cleaned out and then filled by your dental practitioner.

What can your dental practitioner do to stop decay?

- give you the latest information on diet management and decay prevention
- show you a tooth brushing method tailor-made for you
- clean out and fill any teeth that have holes
- seal any deep groves on your chewing surfaces
- put concentrated fluoride on your teeth
- see you for regular checks

What can you do at home to prevent and stop decay?

- use fluoridated water for drinking and preparing food
- eat and drink less sugary things ***between meals*** to stop the acid attack and aid the process of natural repair
- brush ***twice daily*** with a fluoride toothpaste – before bed and in the morning
- take care to do a good job with your brushing
- use fluoride gel, paste, or rinse if recommended
- use an antibacterial gel or rinse if recommended

Your situation is shown on the chart below:

	X-ray shadow	Number of surfaces affected	The most likely situation is	Treatement need
C1	Outer 1/2 of enamel		The surface has ***minimal*** decay which is most likely non-active or arrested.	Normal home care.
C2	Inner 1/2 of enamel		The surface has ***slightly more*** decay which may be non-active or arrested.	Normal home care.
C3	Just into dentine		Decay on this surface is ***just under*** the enamel layer, but is ***probably not*** a hidden cavity.	Special home care depending on risk.
C4	Outer 1/3 of dentine		Decay extends under the enamel layer, and ***it may or may not be*** a hidden cavity.	Special home care and, ***depending on risk***, filling.
C5	Inner 2/3 of dentine		This deep decay needs ***urgent attention.***	Filling plus special home care.

Your current risk of decay is ☐ Low ☐ Medium ☐ High

Your are strongly recommended to attend your next appointment on .....

Fig 3. Tooth decay information leaflet (front side only).

responsibility of the dental practitioner is to ensure that patients understand the diagnosis and management plan.

Diet advice

It is important that patients understand the diet-caries relationship. However, because of the complexity of the diet-caries relationship, the probability that caries risk will be reduced by reducing refined sugar is strong only in the case where there is close to complete absence of sugar in the diet. But since sugar use is ubiquitous in processed food, it cannot be avoided.[5] Nevertheless, dental practitioners accept responsibility for: (a) assessing this dietary risk; (b) bringing this risk to the attention of patients; and (c) providing appropriate advice.

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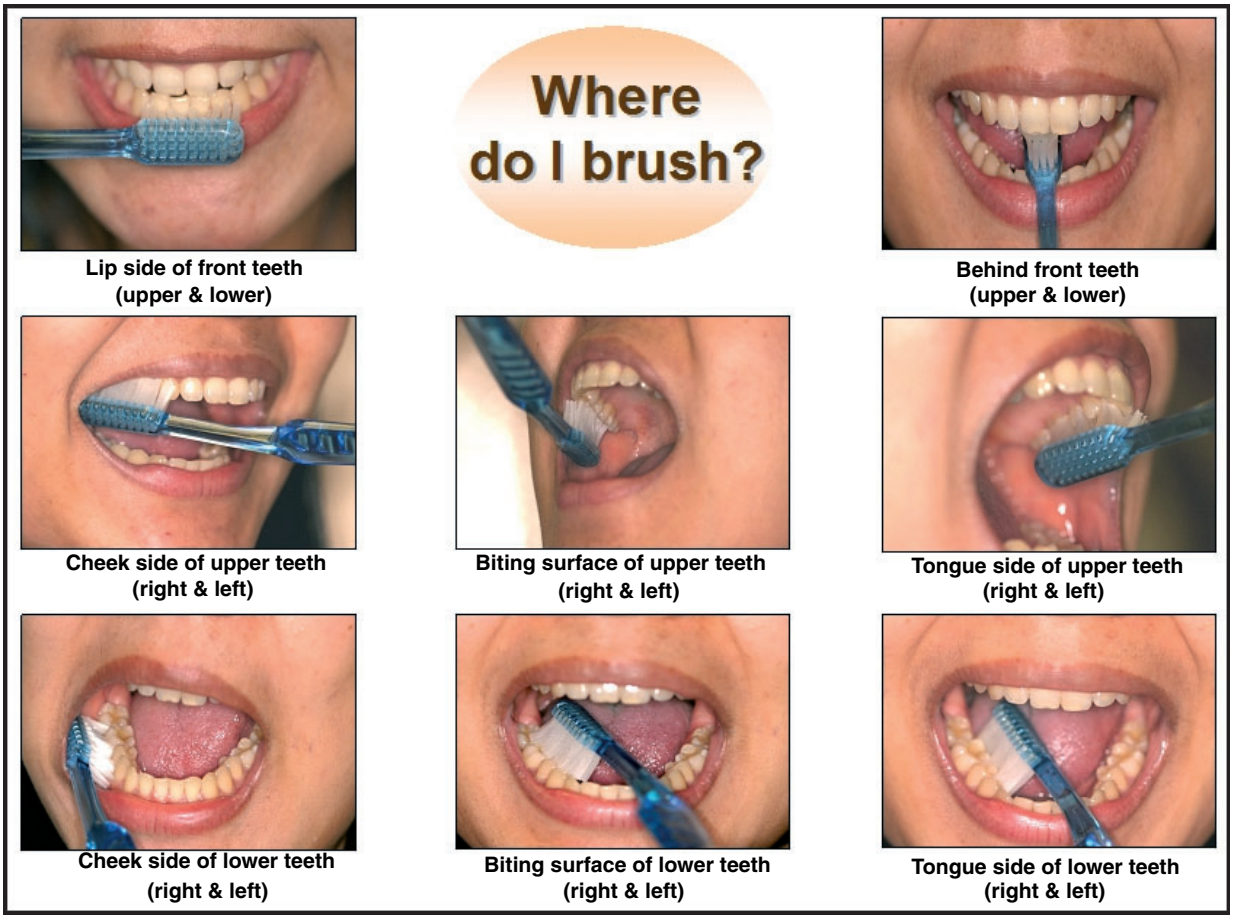

Fig 4. The Where do I brush? leaflet (front side only).

Oral hygiene instruction and coaching

The attainment of effective toothbrushing skills takes time and effort. Oral hygiene instruction and coaching which has as its objective the reduction in the Plaque Index score (or bleeding on probing). Patients are trained to recognize plaque and gingivitis and to observe how quickly gingivitis will resolve following the institution of regular and careful toothbrushing. For very high risk patients, the use of chlorhexidine is indicated. Clinical experience shows that more than two intensive sessions is necessary for patients to reach a level of proficiency and self-motivation that will sustain a lifelong commitment to a habit of twice daily and careful toothbrushing.

The development of oral hygiene skills is facilitated with reference to the Where do I brush? leaflet shown in miniature in Fig 4.[10] The main purposes of this leaflet are: (a) to illustrate toothbrush positions for oral hygiene practice; (b) for reference at future visits to demonstrate where plaque has not been removed; and (c) on the reverse side, to record the diet goals. This leaflet complements the use of models during oral hygiene coaching. Note that the order of the boxes is: left – front – right, i.e., the patient's mirror image.

Clinical management

The risk-based caries management options are: preventive, preservative (non-invasive) and operative (invasive). Cavitated lesions are managed using operative procedures. Sealants should be placed, without the removal of any tooth structure, over pre-cavitated incipient or friable, fissure lesions.[11] They will need to be checked regularly as sustained caries arrest depends on sealant retention.[12]

Most other lesions, discovered as a result of the bitewing survey, are managed with non-invasive methods (Table 5). The application of topical fluorides for preventing, arresting and remineralizing lesions follows protocols relating to professional and home care use (Tables 6 and 7).[13–15] Other than for lesions scored C4, management decisions about individual lesions are relatively uncomplicated. C5 lesions are almost certainly associated with cavitation into dentine and in need of urgent operative treatment if pulp complications are to be avoided. Most C1, C2 and C3 lesions are unlikely to exhibit enamel cavitation and, therefore, do not warrant operative intervention, whereas C4 lesions may or may not be so affected.

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Table 5. Protocol for the management of lesions following caries diagnosis based on the bitewing radiographic survey

Lesion Management Protocol	
Lesion score	Treatment
C1	Do not restore – apply topical fluoride and monitor
C2	Do not restore – apply topical fluoride and monitor
C3	Do not restore – apply topical fluoride and monitor
C4	Do not restore ***without further consideration***
C5	Restore now – it is almost certain that the cavity has breached the DEJ
Caries Risk	Further consideration for surfaces scored C4
Low and Medium	• Restore ***only if*** the radiolucency extends ***fully 1/3*** into dentine, or following tooth separation when cavitation is confirmed • Otherwise ***do not*** restore because it is most likely: ○ that the approximal surface is not cavitated, and ○ that the lesion has arrested • Apply topical fluoride and monitor: ○ to arrest and remineralise active lesions, or ○ to maintain arrested lesions
High	• Restore now • Apply topical fluoride and monitor: ○ to arrest and remineralise lesions not yet showing radiographically, and ○ to prevent recurrent caries

According to the Caries Management System protocol, C4 lesions are scheduled for operative care only where patients are rated as high risk or, for medium and low risk patients, only when the lesion depth extends through fully one-third of the dentine thickness, or when, following tooth separation, cavitation into dentine is confirmed.

Benefits and safety of non-invasive management

Provided that any cavities remain within enamel, the underlying dentine, although affected, remains uninfected and risk of rapid lesion progression is minimal. Radiographic analysis reveals that progression of lesions through enamel is usually very slow. For example, in Holland in 1966, at the height of the caries pandemic, it was estimated that the mean time for lesion progression from enamel to dentine was four years.[16] In Australia today, where the use of fluoridated toothpaste is almost universal and where most people have access to fluoridated water, caries experience in children and adolescents is substantially less than formerly.[17] Accordingly, it may be assumed that lesion progression rates have also declined. Hence, there is no urgency for operative intervention on discovery of lesions scored C4. The C4 lesions are potentially arrestable and time is on the side of success in boosting the natural repair mechanism of remineralization. For low and medium risk patients, it is beneficial and safe to defer the restoration of most C4 surfaces, either indefinitely or until cavitation is proved, because the negative consequences of acting on false positive diagnoses are minimized. That is, if arrested C4 lesions are not restored, then there are no

Table 6. Professional care topical fluoride protocol for adults aged 18 years and over

Topical Fluoride Protocol for Professional Care		
Caries Risk	Fluoride Varnish (Duraphat) 5% NaF (22,600 ppm) or GIC (Fuji 7)	Fluoride Gel 1.23% NaF (12,300 ppm)
Low	1. Apply varnish or GIC to newly erupted wisdom teeth. 2. Yearly applications on lesions until arrested	At recall appointments to maintain lesion arrest.
Medium	1. Apply varnish or GIC to newly erupted wisdom teeth. 2. Apply varnish to all lesions ***at each treatment session***, then 3. ***6-monthly*** varnish applications on lesions until patient becomes low risk.	NOT APPLICABLE
High	1. Apply varnish or GIC to newly erupted wisdom teeth. 2. Apply varnish to all lesions ***at each treatment session***, then 3. ***3-monthly*** varnish applications on lesions until patient becomes medium risk.	NOT APPLICABLE

Table 7. Home care topical fluoride protocol for adults aged 18 years and over

Topical Fluoride Protocol for Home Care			
Caries Risk	Toothbrushing with fluoride toothpaste (pea size)	Fluoride rinse 0.05% (220 ppm) NaF (neutral) ONE MINUTE	Chlorhexidine rinse or gel 0.2% CHX
Low	Twice daily using 1000 ppm	Not applicable	Not applicable
Medium	Twice daily using 1000 ppm	Once daily at a separate time from toothbrushing	Not applicable
High	Twice daily using 5000 ppm	Not applicable	Not applicable
Very high*	Twice daily using 5000 ppm	Not applicable	Once daily before bed

*For example, patients with hyposalivation, or who have active lesions on anterior teeth, or who have active lesions on buccal surfaces of posterior teeth.

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harmful consequences for surfaces that are actually sound although showing white-spot lesions without cavitation.

With referral to the Tooth Decay leaflet, the patient is informed of the potential problem, the probability of arrest, and the potential for arresting the lesion in this case. If, on follow-up, a C4 lesion has not progressed then it is reasonable to conclude that it has arrested, or had already been arrested, and that the surface is probably sound. If, on the contrary, it turns out that the C4 lesions are enamel cavities, they may progress (without detriment in patients on regular recall) and when, at a later regular checkup, the increased depth of the radiolucencies reveals that the lesions have not arrested, they may then be restored.

Unreliable patients and clinical management

An anticipation that unreliable patients would not attend for remineralizing care and would, therefore, be better off if their lesions were restored rather than leaving them to become the cause of dental emergencies, is unfounded. Such patients are better served: (a) with information on their risk; and (b) with assistance on how to manage it. If they fail to act, dentists cannot shoulder responsibility for the consequences, whereas dentists are responsible for the negative consequences of investing in extensive restorative care in hopeless situations where restorations are bound to fail because of uncontrolled disease.

The dentist's main responsibility towards all patients is to help them understand three facts: (a) that serious dental disease is not inevitable; (b) that oral health is relatively simple to attain; and (c) that tooth repairs and replacement parts do not come with lifetime guarantees; they are subject to breakdown necessitating lifelong maintenance including, from time to time, replacement.

Monitoring

Patients are recalled for monitoring caries activity and oral hygiene competency according to a schedule based on caries risk (Table 8). Monitoring of caries activity and patient health behaviour comprises the assessment of: clinical status, dental bitewing radiolucency progression, diet control, plaque control, fluoride exposure and, in extreme cases of hyposalivation, saliva control (but not described here).

Caries activity

The monitoring of lesions through the review of bitewing radiolucencies is the means to assessing caries activity. At recall appointments, the radiolucency status of new bitewings is compared with those of earlier series. Radiolucency regression or stability indicates lesion arrest and the need to maintain preventive care. On the other hand, radiolucency progression and/or the appearance of new lesions, either approximally or elsewhere, indicates caries activity. Accordingly, the patient risk determination is confirmed or amended and this, in turn, indicates which management protocols are to be followed. Consequently, some invasive intervention may be warranted, or the non-invasive measures may need to be applied with greater urgency.

Diet control

A review of diet history from time to time enables trends to be identified and discussed.

Plaque control

At each appointment, the plaque distribution and overall Plaque Index score is recorded. Ongoing oral

Table 8. Recall protocol – schedule for monitoring caries activity and bitewing surveys

	Recall Protocol	
Caries risk	Caries activity	Bitewing survey
Low	• 12 months following completion of treatment plan developed at first visit • then consider 18–24 month recalls	• at first visit • then 12 months later • then every 18–24 months
Medium	• 6 months following completion of treatment plan developed at first visit • then 6-monthly until patient is classified as low risk	• at first visit • then 6 monthly until patient becomes low risk
High	• 3 months following completion of treatment plan developed at first visit • then 3-monthly until ○ home care goals have been achieved for: – oral hygiene – fluoride therapy ○ lesion progression has arrested/reversed and patient is reclassified as medium/low risk	• at first visit • then 6 monthly until patient is reclassified as low risk

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hygiene coaching and encouragement is necessary. The active demonstration of recording plaque or bleeding on probing, and reviewing serial findings at each visit, motivates patients to improve and maintain a high standard of oral hygiene.

Fluoride exposure

More than any other factor, the management of an appropriate fluoride exposure is the key to caries control. In the absence of a positive response to caries arrest, fluoride exposure is increased since it is the intervention that the patient is most likely to manage well. Both professional and home care schedules are adjusted, as necessary, according to patient risk.

DISCUSSION

In this millennium, Kidd and Fejerskov issued a challenge to dental schools to accept responsibility for changing the attitude of dental practitioners to reflect that the more important and complex aspect of care is to arrest lesion progression and prevent cavity development.[18] One of the main reasons for the current attitude is the confusion that is created through the use of the term 'dental caries' for three different entities: (a) the multifactorial, lifestyle-associated bacterial disease that affects individuals within the physical and social context; (b) the actual lesion affecting the dental hard tissues of enamel, dentine and cementum; and (c) the dynamic process of demineralization and remineralization which, on becoming grossly unbalanced, leads to bacterial invasion of the pulp tissues. The literature refers to dental caries in all three contexts with much of the focus being on lesion management as if this was the disease rather than its manifestation.

The Caries Management System is concerned with interventions that are known to be effective in arresting lesions and reducing caries risk in the individual. It is not concerned with the management of dental erosion, which is another issue, unless this is associated with caries. Not included, at this stage, are promising new materials containing casein phosphopeptide-amorphous calcium phosphate (CPP-ACP)[19] which will be considered for inclusion once population clinical trails report on its efficacy.

The challenge to reform dental caries management has been taken up elsewhere. Anusavice[20] published a protocol on 'how modern preservative dentistry can be implemented' and new management principles, involving both preventive and operative strategies which have since been described.[21,22] In particular, the principles and rationale for treating caries as a transmissible bacterial infectious disease were promoted. The main focus was on the primary prevention of caries and detailed options for preventive strategies were reviewed.[23]

With regard to the management of existing lesions, and taking into account the new understanding of caries dynamics, the concept of minimal intervention dentistry was developed, as reviewed by Tyas *et al.*[24] Minimal intervention aims to conserve sound tissue whereas previously the removal of sound dental tissue was not only encouraged but incorporated into restoration design (extension for prevention). The main emphasis of minimal intervention is upon techniques that minimize collateral damage to sound tissues during operative intervention.[25] However, it fails to address the question of how to keep sound teeth sound.

While there is a theoretical basis for recommending that dietary sugar should be reduced, both in relation to caries[26] and other health problems, it should be clearly understood that effective diet counselling protocols aimed at reducing dietary sugar are scant, possibly non-existent.[5] Studies suggest that use of sugar substitutes would be effective in controlling caries and would require people to change their diet, but most people do not change their diet, even to save their lives.[27] But, whatever the diet-related risk, the plaque-related caries risk increases substantially as plaque thickness increases.[28] Since thick plaque indicates accessible sites where the toothbrush (and toothpaste) has not been applied, and since an abundance of strong evidence supports the role of toothbrushing with fluoridated toothpaste in caries risk reduction, a heavy emphasis is placed on this measure in the Caries Management System.

We have not focused on the adjunctive use of chewing gum for adults because gum-chewing is not a mainstream part of adult culture and, like diet, is a behaviour where it is extremely difficult to introduce change.

In cohort studies, it has been demonstrated that implementation of intensive preventive strategies results in substantial reduction in new lesions,[29,30] and arrest and remineralization of existing lesions.[30,31] In general dental practice, similar results have also been reported.[30,32] Such results imply that patients understand the benefits of a non-invasive approach and since they do not enjoy having to endure operative care, are motivated to maintain effective plaque control and topical fluoride use.

The anticipated outcome of implementing the Caries Management System in general dental practice is reduction in caries incidence and increased patient satisfaction. Since the attainment and maintenance of oral health is determined mainly by controlling both dental caries and periodontal disease, the implementation of the Caries Management System in general practice will promote both outcomes.

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