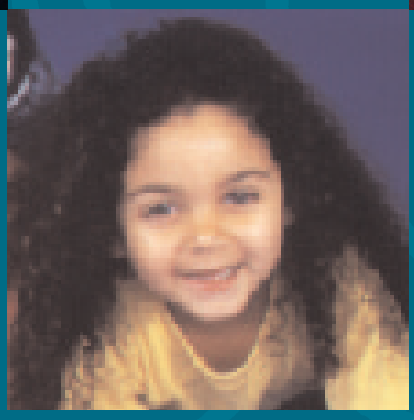
Paediatric Dentistry - UK

National Clinical Guidelines and Policy Documents 1999



DPB

Published by the
Dental Practice Board
for England and Wales

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Front cover: pictures 2, 3 and 4 (left to right) courtesy of the Health Education Authority.

Why Clinical Guidelines?

The purpose of Clinical Guidelines is to improve the effectiveness and efficiency of clinical care through the identification of good clinical practice and desired clinical outcomes.

The Guidelines are statements intended to assist clinicians in making decisions about appropriate management of specific conditions.

This publication, produced by the Faculty of Dental Surgery Paediatric Dentistry Clinical Effectiveness Committee, contains nine guidelines in selected topics related to Paediatric Dentistry.

The aim has been to produce Guidelines which deal with commonly encountered clinical situations and make recommendations on their management. In many areas of practice there is a shortage of reliable research data, so that while some recommendations are supported by robust data, others are made with a lesser degree of confidence, and may represent only "best current practice".

It is hoped that these Guidelines, produced by experts who have reviewed the available evidence, will be welcomed by clinicians and encourage interest in providing the highest possible standards of care. An anticipated benefit is that shortage of data will be highlighted, so stimulating research aimed at improving the scientific foundation of our clinical activity.

It will be important to refine the existing Guidelines as further information becomes available, and the intention is to add to the number of guidelines in future publications.

John Williams
Chairman of Faculty of Dental Surgery Clinical Effectiveness Committee.

THE PROCESS OF NATIONAL CLINICAL GUIDELINE PRODUCTION

In 1994 the Department of Health requested the Royal College of Surgeons to produce National Clinical Guidelines. The Faculty of Dental Surgery delegated this task to the respective Clinical Audit Committees in each of the Dental disciplines of:-

- ORAL AND MAXILLOFACIAL SURGERY
- ORTHODONTICS
- PAEDIATRIC DENTISTRY
- RESTORATIVE DENTISTRY
- DENTAL PUBLIC HEALTH

Draft authors were asked to review the scientific literature on selected topics and produce a draft guideline which was then circulated to an "Expert Panel" for comment and opinion. Expert panels varied according to the subject of the guideline and consisted of individuals who were identified as having a particular expertise in that subject.

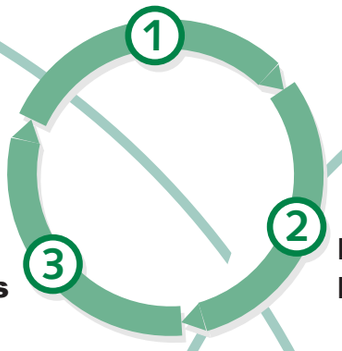
A final Guideline was eventually produced which was assessed, according to the Scottish Intercollegiate Guideline Network (SIGN) classification, as to whether it was based on proven scientific evidence or currently accepted good clinical practice with limited scientific evidence (see table below).

Levels of Evidence

Level	Type of evidence
Ia	Evidence obtained from meta-analysis or randomised control trials
Ib	Evidence from at least one randomised control trial
IIa	Evidence obtained from at least one well designed control study without randomisation
IIb	Evidence obtained from at least one other type of well designed quasi-experimental study
III	Evidence obtained from well designed non-experimental descriptive studies, such as comparative studies, correlation studies and case control studies
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Grading of Recommendations

Grade		Recommendations
A	(Evidence levels Ia, Ib)	Requires at least one randomised controlled trial as part of the body of the literature of overall good quality and consistency addressing the specific recommendations
B	(Evidence levels IIa, IIb, III)	Requires availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation
C	(Evidence level IV)	Requires evidence from expert committee reports or opinions and/or clinical experience of respected authorities. Indicates absence of directly applicable studies of good quality.



Diagnosis & Management

Follow-up Management

Additional Clinical Considerations & References

Where applicable each guideline consists of three broad sections. The first section is a series of recommendations for diagnosis and management. Each recommendation is graded according to the SIGN classification and is clearly marked in the margin - A, B or C.

The second section contains explanatory notes relating to the evolution of these recommendations.

The third section contains references and comments to assist further research into the subject.

It should be understood that a Clinical Guideline is intended to assist the clinician in the management of patients in an effective and efficient way. It is not intended to restrict clinical freedom in the management of an individual case.

Diagnosis & Management

Explanatory notes

Discussion & References

Section 1

Paediatric Dentistry Clinical Guidelines - RCS approved - ie Multi-disciplinary FDS approved Guidelines already published in International Journal of Paediatric Dentistry.

1. Prevention of Dental Caries in Children - Draft Author L Shaw.

2. Treatment of Avulsed Permanent Teeth in Children - Draft Authors T A Gregg and D H Boyd

3. Treatment of Traumatically Intruded Permanent Incisor Teeth in Children - Draft Author M J Kinirons.

4. Continuing Oral Care - Review and Recall - Draft Author P J Crawford.

5. Management and Root Canal Treatment of Non-vital Immature Permanent Incisor Teeth - Draft Author I Mackie.

PREVENTION OF DENTAL CARIES IN CHILDREN

INTRODUCTION

Although children are at risk from conditions affecting both dental and soft-tissues, by far the commonest of these in childhood is dental caries, therefore, these guidelines consider the prevention of dental caries which is a multifactorial disease. Prevention requires a multifactorial approach including dietary factors and eating habits, the use of appropriate fluoride therapy, the application of fissure sealants and the implementation of effective oral hygiene.

MANAGEMENT

1. Indications for Preventive Therapy

Preventive dental care is important for all children and adults but there are certain circumstances which are indicative of increased risks of disease or its consequences. (See table 1.)

1.1 General factors

1.1.1 Low socio-economic group[1]

B

1.1.2 Medically compromised patients[2], at risk from caries and its sequelae

1.1.3 Children with special needs, including learning difficulties

1.1.4 Children on long term medication containing sugar[3]

1.2 Local factors

1.2.1 Evidence of past caries experience

B

1.2.2 Greater than 3 sugary intakes per day - greater than 10 per cent of energy from non-milk extrinsic sugar consumption[4]

1.2.3 Poor oral hygiene

1.2.4 Lower salivary flow

1.2.5 Orthodontic appliance therapy

2. Preventive Therapy Methods and Techniques

2.1 Dietary Control

Recommendations:

2.1.1 For "at risk" children, a 3 - 4 day dietary diary should be completed and discussed.

B

2.1.2 Give dietary counselling which is specific to the child and family, based on the dietary diary.

2.1.3 Set limited, obtainable targets initially.

2.1.4 Monitor compliance.

2.1.5 Infants should not be left to sleep with a bottle containing sugary liquids or those with a low pH which may also cause erosion. Prolonged use of feeding bottles should be avoided. Fruit flavoured sugar containing drinks should be limited to meal-times. Thirsty children will drink water.[8]

2.1.6 Educate the public, particularly through school health education programmes about the known association between frequent consumption of sugars and dental caries.

2.1.7 Support future research and education to promote balanced diets and the use of sugars in moderation.

2.1.8 Paediatric medicines should be sugar free.

2.1.9 Prolonged breast feeding should be discouraged.

2.2 Fluoride Therapy

Recommendations:

A

2.2.1 *Water Fluoridation*
Optimal fluoride in drinking water supplies remains the cornerstone of any preventive dentistry strategy.

A

2.2.2 *Fluoride Toothpaste*
All children should regularly use a correctly formulated fluoride toothpaste according to the manufacturers' and dentists' instructions. To reduce the risk of opacities, children under the age of 6 years and considered to be at low risk of developing dental caries should use a toothpaste containing no more than 600 ppm of fluoride. Those with a higher risk of developing caries should use a standard (1000 ppm) paste.[10]

Children over the age of 6 years should be encouraged to use a standard (1000 ppm) or higher (1450 ppm) fluoride level paste.[11]

Toothpastes accredited by the British Dental Association should be recommended.[11]
Children under 6 years should use an amount of toothpaste no greater than a small pea.[11]
An adult should supervise the amount of toothpaste used and tooth brushing technique, up to at least 7 or 8 years.[11]

Toothpaste packaging must include clear labelling to indicate the amount of fluoride present, expressed consistently as ppmF.

A

2.2.3 *Fluoride Supplements*
For children at risk of dental caries (see table 1) dietary fluoride supplements should be considered. The small potential risk of mild enamel opacities may be outweighed by the benefits of fluoride supplements.[7]

When fluoride is given as tablets, these should be allowed to dissolve slowly in the mouth in order to give a topical as well as a systemic effect. They should preferably be given at a time separated from toothbrushing to help to reduce the peaks of fluoride ingestion and to maximise the topical effect.

For children living in an area where there is no more than 0.3 ppm fluoride in the drinking water, the currently recommended dosage schedule should be used (as of 1995).[11]

2.2.4 *Professionally applied topical fluoride treatment*

A

Topical fluoride varnishes are of proven benefit in preventing caries and in helping to arrest caries in children with "nursing bottle caries" and cervical decalcification. These are highly concentrated vehicles for fluoride and the recommended dose must not be exceeded.[9,12]

Other forms of professionally applied fluoride gels (1.23 per cent acidulated phosphate fluoride APF) and solutions (8 per cent stannous fluoride) are recommended by some authorities[6] but have been shown to be of poor cost benefit,[9,12] although clinically beneficial. Children at high caries risk should be considered for application of topical fluorides twice yearly.

2.2.5 *Self or parent-applied fluoride for children at high caries risk.*

B

Home fluoride treatments using mouthrinses can be recommended for daily use in children over 6 years.

If a high caries risk patient cannot comply with home fluoride therapy then frequent professional fluoride treatments should be substituted.

2.3 Fissure sealants.

Recommendations:

2.3.1 *Patient selection*

C

Children with special needs are a priority for the use of fissure sealants. They should be considered for those who are medically compromised, physically or dentally disabled, together with those having learning difficulties or those from socio-economically disadvantaged backgrounds.

Children with extensive caries in their primary teeth should have all permanent molars sealed as soon as possible after eruption.

Children with caries free primary dentitions and who do not fall into one of the categories above do not need to have first permanent molars sealed routinely.

2.3.2 *Tooth selection*

C

Fissure sealants have greatest benefit on the occlusal surfaces of permanent molar teeth. However, other surfaces with pits, particularly the buccal pits in lower molars and cingulum pits in upper incisors, should also be considered.

Fissure sealing of primary molars is not normally advised.
Sealants should usually be applied as soon as the teeth have erupted sufficiently to permit moisture control.

Any child with occlusal caries in one first permanent molar should have the other molars sealed. Occlusal caries affecting one or more first molars indicates a need for the second permanent molars to be sealed.

2.3.3 *Clinical circumstances*

B

When there is doubt about the integrity of an occlusal surface on clinical examination a bite-wing radiograph should be taken.

If early dentine involvement is suspected the fissure should be investigated using small burs. If minimal caries is discovered, a composite resin restoration should be placed and the whole surface sealed.

If extensive caries is discovered a more conventional occlusal restoration should be placed.

2.3.4 *Long term follow up*

B

Sealed teeth should be monitored clinically at appropriate intervals supported by radiographs. Defective sealants should be investigated and re-sealed if appropriate.

Fissure sealants need to be maintained and this must be explained to parents.

2.4 Oral Hygiene

Recommendations:

2.4.1 Toothbrushing skills should be taught to children of all ages. The precise technique is less important than the effectiveness of removal of plaque, the use of disclosing tablets or liquids is helpful.

C

2.4.2 Use of a fluoride toothpaste with effective toothbrushing is important (see 2.2.2).

2.4.3 Parents should supervise toothbrushing.

EXPLANATORY NOTES

2

2.1 *The Committee on Medical Aspects of Food Policy has validated the relationship between sugar and dental caries in the clearest terms.*[5] *This has been reinforced by reports such as the Scientific Basis of Dental Health Education and the Oral Health Strategy for England.*[7]

Children who have already experienced dental caries or who are at risk from the consequences of dental caries should have a dietary diary completed over a 3 to 4 day period. Analysis of this should enable dietary counselling to be given which is specific and matched to the needs and circumstances of the child and family.
Non-sugar sweeteners are safe for teeth and useful substitutes for sugar when it is not possible to

discourage a liking for sweetness. They are not permitted for use in foods and drinks for infants.

***2.2** The use of fluorides for the prevention and control of dental caries is documented to be both safe and highly effective. Optimising fluoride in water supplies is an ideal public health measure because it is effective, relatively inexpensive, is not socially divisive and does not require conscious daily co-operation from individuals.[9]*

In many areas of the UK, however, failure to implement this measure means that fluoride needs to be supplied as a dietary supplement, as fluoride toothpaste, and in children at risk of developing dental caries, as topical applications.

There has been some concern regarding enamel mottling and the ingestion of fluorides. It must be made clear that it is the misuse, rather than the use, of such fluoride agents as toothpastes and supplements which constitutes the main fluorosis risk.

***2.3** The British Society of Paediatric Dentistry published revised guidelines on the use of fissure sealants in 1993.[13] First and second molar teeth continue to be the most caries susceptible permanent teeth with the pattern of caries now principally involving the pits and fissures.*

The decision to carry out fissure sealants should be made on clinical grounds, based on a thorough clinical examination of both the child and his/her teeth, supported by radiographs where appropriate and taking into consideration the patient's co-operation, medical history, past caries experience and the family environment.

***2.4** The achievement and maintenance of high levels of oral hygiene are particularly important as far as a healthy periodontium is concerned. There is little scientific evidence to support the theory that toothbrushing per se will prevent dental caries, as normal brushing inevitably leaves some plaque in fissures and other stagnation sites where caries occurs. However, the use of a fluoride toothpaste with the toothbrush is obviously of benefit. Children cannot clean effectively until they are able to undertake such tasks as writing their own names legibly. Until this time parents should clean their child's teeth.*

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12. Murray J J, Rugg-Gunn A J and Jenkins G N 1991 Fluorides in caries prevention. 3rd edition published by Butterworth-Heinemann 179-208.

13. British Society of Paediatric Dentistry A policy document on fissure sealants 1993. International Journal of Paediatric Dentistry 3:99-100.

Table 1 FACTORS THAT AFFECT THE LEVEL OF CARIES RISK IN CHILDREN

	LOW RISK	HIGH RISK
GENERAL		
Social	Mother's education: secondary, tertiary Good attendance pattern Family: nuclear, social class I, II, IIINM, employment	Mother's education: secondary only Poor attendance pattern Family: single parent, social class IIIM, IV, V, unemployment
General health	Good health No sugar-containing medication	Poor health/chronically sick Medication containing sugar
LOCAL		
Oral hygiene	Good oral hygiene, regular brushing twice per day with assistance	Poor oral hygiene, irregular brushing without assistance
Diet	≤ 3 sugary intakes per day	≥ 3 sugary intakes per day
Fluoride experience	Regular brushing with fluoride toothpaste Optimally fluoridated water	Irregular use of fluoride toothpaste No fluoridated water supply
Past caries experience	dmft ≤ 1, DMFT ≤ 1 No initial lesions Caries free first permanent molars at 6 - 8 years of age 3 year caries increment ≤ 3	dmft ≥ 5, DMFT ≥ 5 ≥ 10 initial lesions Caries in first permanent molars at 6 years of age 3 year caries increment ≥ 3
Orthodontic Treatment	No appliance therapy	Fixed appliance therapy

TREATMENT OF AVULSED PERMANENT TEETH IN CHILDREN

INTRODUCTION

The following guidelines are intended to assist in the management and treatment of avulsed teeth in children. They should be used by practitioners in combination with their own professional judgement. Although it is impossible to guarantee a good long term prognosis or permanent retention of a tooth which has been re-implanted following avulsion, timely treatment of the tooth in the appropriate manner maximises the chance of success. Further detail is available under "Explanatory Notes".

INITIAL MANAGEMENT

1. Management at Site of Accident

1.1 If telephone advice is sought, and re-implantation is appropriate (see Additional Considerations) advise re-implantation of the tooth immediately. If the tooth is contaminated, rinse in milk or tap water prior to re-implantation. The tooth may be held in place by gently biting on a clean folded handkerchief until splinting can be carried out. Advise to attend a dental surgeon immediately.

1.2 If immediate re-implantation is not possible, place tooth in a vessel containing suitable storage medium - in order of preference:

cold fresh milk
normal saline
saliva (in buccal sulcus)

Advise to attend a dental surgeon immediately.

2. Initial Management by Dental Surgeon

2.1 *History*
During examination place tooth in cold fresh milk or normal saline to prevent unnecessary drying. Elicit careful medical, dental and accident history, clearly written. Be alert to concomitant injury including head injury, facial fracture or lacerations. Seek medical examination as necessary. Avoid unnecessary delay before re-implantation.

2.2 *Re-implantation*
Replant as soon as possible if re-implantation is appropriate (see Additional Considerations). Local anaesthesia is required if there is alveolar fracture and manipulation is required. Local anaesthetic is also preferable in some cases to enable accurate re-implantation but it is still possible to re-implant a tooth if patient compliance prevents the administration of local anaesthetic.
Preparation of socket - avoid unnecessary manipulation. If clot is present gently irrigate socket with saline in syringe and use suction to remove clot, but avoid curettage.

Handling of tooth - handle by crown NOT root. Do not scrape or scrub root surface. If contaminated wash in normal saline, and only if necessary gently dab with gauze soaked in saline to remove stubborn debris.

If alveolar bone fragments prevent re-implantation withdraw tooth and replace in saline. Introduce a blunt instrument into the socket to reposition bone, and once again attempt re-implantation.

DO NOT COMMENCE ROOT CANAL TREATMENT PRIOR TO RE-IMPLANTATION except in special circumstances - see 4.4 Additional Considerations.

2.3 *Splinting*
Splint to adjacent teeth non-rigidly for 7-10 days. Acid etch/resin either alone or in combination with soft arch wire is most commonly recommended, however other types such as a removable acrylic splint or orthodontic brackets and wire are also acceptable.

All patients should be reviewed following re-implantation within 48 hours, at which time the splint is checked and modified if necessary.

Home care advice during splinting includes avoidance of biting on splinted teeth, consumption of a soft diet, and maintenance of good oral hygiene by tooth brushing and rinsing with chlorhexidine mouthwash.

If excessive mobility persists after ten days replace splint until mobility acceptable.

2.4 *Antibiotics and Tetanus*
Prescribe appropriate systemic antibiotics to commence as soon as possible. A tetanus booster may be required if environmental contamination has occurred. If in doubt refer to physician within 48 hours.

3. Follow-up Management by Dental Surgeon

3.1 *Endodontic Treatment - Open apex teeth in young patients - short extra-oral time*
In open apex teeth in young patients when the tooth has been out of the socket for a short period only it is acceptable to delay endodontic intervention to allow for the possibility of pulp revascularisation.

Review in two weeks then at three to four week intervals; at review look for clinical signs of non-vitality (tenderness, tooth discolouration, swelling/sinus), test vitality and take intra-oral radiograph. If clinical and radiographic signs of non-vitality develop commence endodontic treatment. Thorough mechanical cleansing of the canal is essential regardless of which dressings are used. Clean canal mechanically and fill with calcium hydroxide. An antibacterial intra-canal dressing may be placed for one to two weeks prior to placement of calcium hydroxide to help to ensure that the

canal is free from infection. If calcium hydroxide is used alone then this should be placed no sooner than 7 days following re-implantation. The access cavity should be temporarily sealed with fast setting zinc oxide and eugenol or glass ionomer cement. Calcium hydroxide is left inside the canal until apexification has occurred. Regular clinical and radiographic review is necessary. It may be necessary to place fresh calcium hydroxide if follow-up radiographs reveal that there are voids in the existing calcium hydroxide root canal dressing. Some authorities recommend renewing the calcium hydroxide root canal dressing every 3 months but this is not proven to be absolutely necessary.

C

3.2 *Endodontic Treatment - All other teeth*
Commence endodontic treatment in all teeth with closed or almost closed apex regardless of extra-oral time and open apex teeth with prolonged extra-oral time.

Remove pulp as soon as tooth stable enough for access cavity to be prepared - ideally within 10 days. If an acid etch/resin splint has been used endodontic treatment can be commenced prior to its removal.

Thorough mechanical cleansing of the canal is essential regardless of which dressings are used. Clean canal mechanically and fill with calcium hydroxide. An antibacterial intra-canal dressing may be placed for one to two weeks prior to placement of calcium hydroxide to help to ensure that the canal is free from infection. If calcium hydroxide is used alone then this should be placed no sooner than 7 days following re-implantation. The access cavity should be temporarily sealed with fast setting zinc oxide and eugenol or glass ionomer cement. Calcium hydroxide is left inside the canal for a period of 6 - 12 months before final obturation with gutta percha. Regular clinical and radiographic review is necessary. It may be necessary to place fresh calcium hydroxide if follow-up radiographs reveal that there are voids in the existing calcium hydroxide root canal dressing. Some authorities recommend renewing the calcium hydroxide root canal dressing every 3 months but this is not proven to be absolutely necessary.

3

4. Additional Considerations

4.1 When NOT to replant - in most cases re-implantation of an avulsed tooth is the best treatment. However, in a few cases re-implantation is not appropriate. These are as follows:

- Primary tooth
- Where other injuries are severe and warrant preferential emergency treatment/intensive care
- Where medical history indicates that the patient would be put at risk by re-implantation of a tooth
- Where an immature permanent tooth with a short root and wide open apex is involved, and the extra-oral time is extremely prolonged, the prognosis is very poor.

C

In many of these cases re-implantation may not be warranted (see explanatory notes 4.1).

4.2 Replanted permanent teeth require follow-up evaluation for a minimum of 2 - 3 years to determine outcome. Inflammatory resorption, replacement resorption, ankylosis, infraocclusion, and discolouration are all potential complications which may occur. If progressive resorption occurs prosthetic assessment, and/or orthodontic assessment may be required.

4.3 At follow up visits adjacent teeth should also be examined as these may have been damaged as a result of the same accident and should not be overlooked.

4.4 In cases of extremely prolonged periods of extra-oral time in teeth with closed apices, where an undesirable storage medium has been used (i.e. tap water, or dry storage) a different method of treatment has been suggested. The treatment involves complete removal of the periodontal membrane and immersion of the tooth in a fluoride solution. As further drying and handling of the tooth root is unlikely to worsen the prognosis in such a case, some authors suggest that endodontic treatment may be completed extra-orally before re-implantation.

4.5 Some recent articles have suggested soaking of avulsed teeth in a pH balanced solution prior to re-implantation to reconstitute periodontal ligament cells. Further, it has been suggested that soaking of avulsed teeth in an antibiotic solution prior to re-implantation improves the prognosis and may be more effective than systemic antibiotics. These suggestions remain controversial.

2

EXPLANATORY NOTES

The incidence of traumatic avulsion of teeth has been reported as 0.5 - 16 per cent of all traumatised teeth.[1, 2] Upper central incisor teeth are most frequently avulsed, and in the age group 7 - 9 years.[1,3]. It has long been recognised that it is possible to replant a tooth following avulsion, and that replanted teeth may function for many years. Andreasen found in monkeys that, under ideal conditions, complete healing of the pulp and periodontal ligament of replanted teeth can occur.[1] However such conditions do not occur in the real life situation and healing of replanted teeth is subject to complications. The main complication is that of root resorption which is related to necrosis of part or all of the periodontal ligament and may be further complicated by necrosis of the pulp and/or infection. Although the damage caused directly by the injury is beyond the control of the clinician, the provision of appropriate treatment both immediately and upon review improves the prognosis of replanted teeth.

1.1 The period between tooth avulsion and re-implantation is normally outwith the control of a dentist but this period is important with regard to the prognosis of the tooth. It has been reported that the length of time that a tooth spends out of the mouth influences the development of root resorption and pulpal healing. Andreasen and Hjorting-Hansen found that 90 per cent of teeth replanted within 30 minutes did not develop root

resorption when reviewed at an interval ranging between 1 - 13 years, however this much quoted finding was based on 10 teeth and as such the reporting of this as a percentage may be misleading.[4] Andersson and Bodin found that teeth replanted within 15 minutes following the avulsion have a favourable long term prognosis, and furthermore that most of the teeth with no resorption had been replanted within 10 minutes.[5] Andersson, Bodin and Sorensen concluded that teeth replanted after 60 minutes would become ankylosed and resorbed within 3 - 7 years in young patients whereas a tooth replanted under similar conditions in older patients might remain in function for a considerably longer time.[6] However Mackie and Worthington found no significant relationship between the time that the avulsed tooth was out of the mouth and root resorption.[7] In terms of pulpal healing Andreasen et al found that the liklihood of pulpal revascularisation was reduced as the extra-oral dry time increased, and similarly with storage in a moist medium for longer than 5 minutes.[8]

1.2 The medium in which the tooth has been stored prior to re-implantation has been shown to affect the incidence of root resorption and pulp healing. Prolonged drying of the root presents the worst prognosis because of loss of vitality of the periodontal ligament [9, 10, 11] and dehydration of the pulp.[8] Ideally the tooth should be re-implanted into the socket as soon as possible, but in cases where this cannot be carried out, maintaining the root in a moist environment has been shown to improve the prognosis. However storage in tap water has been demonstrated to be an unsatisfactory medium.[9] A critical period of dry storage has been reported to be between 18 and 30 minutes after which a marked increase in root resorption is seen.[12] Cold fresh milk appears to be the best medium for storage of the tooth during transportation to a dentist[13] although alternatives such as saliva, blood, saline and an "emergency tooth preserving system" have all been suggested.[14] The "emergency tooth preserving system" contains a pH-balanced cell reconstitution fluid called Hank's Solution. Recent U.S.A. literature has found that avulsed teeth soaked in this solution prior to re-implantation suffer less resorption.[15] Also, increased pulp revascularisation has been claimed following soaking of avulsed teeth in a 5 per cent doxycycline solution prior to re-implantation.[16]

2.1 As with all cases of trauma it is essential to record details of the accident clearly in writing because of the possibility of legal action on the part of the patient. A thorough history should be taken and examination should exclude facial fracture. Mucosal lacerations may require suturing. The parent/carers should be alerted to be suspicious of any subsequent dizziness, neck pain, amnesia, headache or symptoms of head injury. If there are symptoms of head injury a medical assessment should be arranged immediately.

2.2 The handling of the tooth prior to re-implantation is highly important to avoid further damage to the periodontal membrane.[1] Therefore during examination of the patient prior to re-implantation the tooth should be placed in a safe place in milk or saline. Re-implantation of a tooth may be carried out without local anaesthesia, especially if presentation to the dentist is soon after avulsion, and a soft blood clot only is present. In many cases local anaesthetic is desirable to enable adequate socket preparation and positioning of the tooth. If there is a clot present in the socket this can be washed out with a syringe and saline and an aspirator. It is not desirable to curette the socket as this will cause further damage to or removal of the periodontal ligament cells which remain in the socket.

A past favoured method of treatment involved carrying out root canal treatment of avulsed teeth prior to re-implantation. In most cases this method of treatment is no longer acceptable as it imparts a poorer prognosis because of increased damage to the periodontal ligament cells by prolonged drying and handling. It is also desirable to maintain a patent root canal as a vehicle for application of medicaments to reduce infection and/or resorption. However, in a few special cases it may be acceptable to complete endodontic treatment prior to re-implantation - see section 4. Additional Considerations.

2.3 It has been suggested that minimising the time duration of splinting and using a non-rigid splint will improve the outcome of the re-implanted tooth and reduced the occurrence of ankylosis.[8, 17, 18] There are a number of suitable types of non-rigid splint[19, 20, 21, 22] which will depend on the facilities available. Care must be taken in application i.e. avoid impinging on gingivae or creating areas of stagnation. The immediate splint is often placed in an emergency situation and requires to be simple but effective. In such cases a review appointment should be arranged ideally within 48 hours of the accident. At this review the splint should be checked and if necessary modified or removed and replaced.

2.4 It has been suggested that the provision of systemic antibiotics reduces the occurrence of root resorption and in particular inflammatory resorption if taken promptly.[23, 24] In cases of environmental contamination a tetanus booster may be required.

3.1 Early removal of the pulp has been advocated as this will prevent the production of inflammatory products by a necrotic pulp, and thus minimise the chance of inflammatory resorption.[25] Although the advice regarding teeth with a wide open apex is to delay endodontic treatment on the basis that revascularisation of the pulp is possible[1], this involves a risk of failure due to inflammatory root resorption[26], and clinicians must be aware of the consequences of too conservative an approach. Inflammatory resorption appears to occur more rapidly in young patients and the proposed reason for this is that the dentine tubules, which have not yet become less patent as is the case with advancing age, readily transmit inflammatory products from the pulp to the root surface.[27] Therefore it is proposed only to delay endodontic treatment in

those cases where the apex is wide open and the tooth has been re-implanted promptly. In cases where delay of endodontic treatment has been chosen, the clinician must carry out careful review of the patient so that pulp removal can be carried out at the first sign of inflammatory resorption. All other re-implanted teeth should have endodontic treatment. Pulp removal as soon as the tooth is stable enough for an access cavity to be prepared is advisable, and ideally within 10 days. It may be helpful to do this prior to removal of the splint. A past favoured method of treatment involved carrying out root canal treatment of avulsed teeth prior to re-implantation. This method of treatment is no longer acceptable as it imparts a poorer prognosis because of increased damage to the periodontal ligament cells by prolonged drying and handling. It is also desirable to maintain a patent root canal as a vehicle for application of medicaments which may help to reduce infection and/or resorption. However, in only a few special cases it may be acceptable to complete endodontic treatment prior to re-implantation - see section 4. Additional Considerations.

3.2 Use of an intra-canal medicament has been advocated as this has been shown to reduce the occurrence of root resorption.[23, 24] Inflammatory resorption may be arrested by endodontic treatment which removes the source of inflammation, but ankylosis may still occur because of irreversible damage to the periodontal ligament.[27] The high pH of calcium hydroxide renders it bacteriostatic and therefore a suitable intra-canal dressing where inflammatory resorption has occurred. It may be that placing calcium hydroxide in the root canal encourages healing[1], however there is no conclusive evidence regarding this and some authors have shown that presence of calcium hydroxide in the root canal may in some circumstances increase the occurrence of ankylosis.[28, 29] Also, in experimentally induced inflammatory resorption placement of an intra-canal antibiotic and corticosteroid paste was found to eliminate the inflammatory resorption.[30] Some authorities recommend the use of an intra-canal polyantibiotic paste used containing neomycin sulphate, polymyxin B sulphate, nystatin, polyethylene glycol 1300 and polyethylene glycol 1500. This is also acceptable. If an antibiotic dressing is used this should be replaced by calcium hydroxide after a period of 1 - 2 weeks. If calcium hydroxide is placed as the sole dressing this should not be placed until the tooth has been replanted for over 7 days as insertion of calcium hydroxide any sooner than this can in fact cause damage to the healing periodontal ligament.[1],[31] Different authors have suggested varied periods of placement of calcium hydroxide. Some suggest that in closed apices early obturation with gutta percha is as acceptable as delaying this until calcium hydroxide has been placed for several months.[32] Although this is controversial, most still advise the latter, therefore it is recommended that calcium hydroxide should be left in the root canal for 6 to12 months before obturation, and changed during this time if indicated. An indication to replace with fresh calcium hydroxide would be if radiographically there was no evidence of any material present in the root canal, or if there are voids in the existing dressing. Some authorities recommend renewing the calcium hydroxide root canal dressing every 3 months but this is not proven to be absolutely necessary. As well as preventing inflammatory resorption, calcium hydroxide stimulates apexification in open apex cases. No matter which medicaments are used it is of the greatest importance that the root canal is thoroughly mechanically cleansed.

4.1 Although in many cases a replanted tooth survives only a matter of years, during this period it serves as a natural space maintainer whilst growth occurs, and also enables alveolar height to be preserved. Therefore in most cases re-implantation of an avulsed tooth is the best treatment. However, in certain instances of excessively prolonged extra-oral time/poor storage medium, or where the tooth is grossly carious/ general oral condition is poor, or patient co-operation is poor, a clinician may judge that re-implantation is better not to be attempted. In a few cases re-implantation is clearly not appropriate. These are as follows:

Primary teeth - these should not be replanted because of the possibility of damage to an underlying developing permanent tooth.

Other injuries - where other injuries are severe and require preferential emergency treatment or intensive care.

Medical history - avulsed teeth should not be replanted in cases where to do so would place the patient at risk. For example, patients with depressed immunity as in acute lymphoblastic leukaemia who are at risk from infection. It may be possible in some cases to safely re-implant teeth in such individuals but this should only be carried out in liaison with the specialist physician in charge of their medical care, and a follow-up review and treatment regime must be strictly adhered to.

Immature permanent tooth with short root, wide open apex and prolonged dry extra-oral time - if the dry extra-oral time is long then replacement resorption is inevitable. As replacement resorption occurs at a higher rate in a young person, and these teeth already have a short root, the prognosis is very poor. In most of these cases reimplantation is not warranted, however in some cases one may feel that for psychological reasons it is worth replanting even though the tooth will only last for a short time.

4.2 Inflammatory resorption may be detected as early as two weeks post-re-implantation.[1] Radiographically inflammatory resorption is characterised by loss of root surface accompanied by loss of adjacent bone and an area of radiolucency. Clinically a tooth with inflammatory resorption may be mobile and tender.

Replacement resorption may be diagnosed within two months of re-implantation, however

frequently is not detected until more than 6 months have elapsed.[1] Radiographically replacement resorption is characterised by loss of root surface with loss of periodontal ligament space and lamina dura, and bone is seen to be in direct contact with the root surface. Clinically the tooth has no physiological mobility and may give a high note on percussion. If no form of resorption has been detected in the first two years following re-implantation then the risk of root resorption occurring is considerably reduced.[1] Successive visits for radiographs to identify root resorption are required so that any necessary plans may be made for prosthetic replacement of the tooth should its loss become inevitable.

4.3 It is necessary at follow up visits to examine adjacent teeth which may also have suffered damage as a result of the same accident and should not be overlooked. They should be examined for signs and symptoms of loss of vitality.

4.4 In cases of extremely prolonged periods of extra-oral time in teeth with closed apices, where an undesirable storage medium has been used (i.e. tap water, or dry storage) a different method of treatment has been suggested.[1,15,33] In such circumstances of delay and poor storage, replacement resorption is inevitable as few or no periodontal ligament cells remain viable, and as such treatment is aimed to retard the resorptive process. The treatment involves complete removal of the periodontal membrane and immersion of the tooth in a fluoride solution. The fluoride incorporated in the root surface is thought to retard replacement resorption. As further drying and handling of the tooth root is unlikely to worsen the prognosis in such a case, some authors suggest that under these circumstances endodontic treatment may be completed extra-orally before re-implantation.[1,33]

4.5 Some recent articles have suggested soaking of avulsed teeth in a pH balanced solution prior to re-implantation to reconstitute periodontal ligament cells.[15] Also, increased pulp revascularisation has been claimed following soaking of avulsed teeth in a 5 per cent doxycycline solution prior to re-implantation.[16]

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TREATMENT OF TRAUMATICALLY INTRUDED PERMANENT INCISOR TEETH IN CHILDREN

INTRODUCTION

There is a lack of general agreement and scientific evidence concerning the best treatment for traumatically intruded permanent teeth in children. Although these injuries may be very severe, they occur relatively rarely and this factor has made it difficult to determine the most appropriate treatment for these injuries.

The following guidelines are intended to be of assistance to practitioners who may be involved in the management of such cases. It is difficult to predict the long term prognosis for these injuries as they are frequently of a severe nature but the appropriate decisions and treatments can minimise the chances of difficult complications and consequent loss of teeth. Further details are available under "Explanatory Notes".

DIAGNOSIS AND MANAGEMENT

1. History and Examination

A careful medical and dental history should be obtained along with details of the accident and they should be carefully recorded. A large degree of force is required to severely intrude permanent incisor teeth. One should be alert to the possibility of other injuries, including injuries to the head and facial region.

In the established dentition, diagnosis is based on a difference in the position of the incisal edges of affected and unaffected teeth while in the mixed dentition a high metallic note on percussion is indicative of intrusion or lateral luxation. Radiographic examination is needed and may reveal differences in apical levels, alveolar fractures or signs of damage to adjacent teeth.

2. Treatment

Extra-oral and intra-oral lacerations and wounds should be cleaned and sutured as appropriate. Systemic antibiotic treatment and tetanus boosting may be required if external contamination has occured. Decisions regarding treatment vary according to the severity of intrusion and whether the tooth has a complete or incomplete root. The aim of treatment is that the tooth be maintained if possible, but very severe injuries may require tooth extraction in some circumstances.

2.1 Repositioning of teeth with incomplete Apex

2.1.1 *Mildly intruded (less than 3mm) incisors with incomplete apex*
These teeth can normally be managed conservatively due to their excellent eruptive potential. Leave to re-erupt and review.

2.1.2 *Moderately intruded (3-6 mm) incisors with incomplete apex*
These teeth may re-erupt if managed conservatively. Alternatively these teeth may be orthodontically repositioned by bonding an orthodontic bracket to their labial or incisal region depending on access and isolation, and by applying a sufficient force to extrude the tooth to its normal position in approximately 2 weeks. The relative benefits of either treatment is unproven scientifically and treatment choice is by clinical judgment and preference.

2.1.3 *Severely intruded (greater than 6mm) incisors with incomplete apex*
In this case the alveolus is grossly dilated labially and occasionally fractured and there is often severe soft tissue displacement and the crown may be completely buried. In this instance orthodontic repositioning is difficult or impossible. Consideration should be given to surgically repositioning the tooth. The child's level of co-operation should be taken into consideration. When possible local anaesthesia should be administered and the tooth should be gently repositioned. Repositioning can normally be accomplished by very gentle movements using sterile flat plastic instruments. In resistant cases consider the possibility of bony impaction and release of the impediment prior to repositioning of the labial plate of bone and soft tissue closure and suturing.

In some cases sedation or even general anaesthesia may be necessary. If in doubt consider getting advice from, or referring to, a specialist centre.

2.2 Repositioning of teeth with complete Apex

2.2.1 *Mildly intruded (less than 3mm) incisor with complete root*
These teeth may be orthodontically repositioned over a period of approximately 2 weeks. Alternatively conservative management can be used. The relative merits of these two treatments is unproven and treatment choice is by personal preference.

2.2.2 *Moderately intruded (3-6mm) incisor with complete root*
These teeth should be repositioned orthodontically.

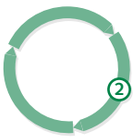
2.2.3 *Severely intruded (greater than 6mm) incisor with complete apex*
These teeth may need to be repositioned surgically and appropriate tissue repair carried out and this is best undertaken in a specialist centre.

3. Splinting of Repositioned Teeth

Intruded teeth that are surgically repositioned require appropriate splinting. There are a number of types of non rigid splints 1-3 and the choice may depend on the facilities available and by the difficulties imposed by haemorrhage. An intruded short rooted tooth with severe damage to the alveolar bone may pose special difficulty.The splinted tooth should be out of traumatic occlusion. In all cases a review appointment should be arranged, ideally within five days of the accident. At this review the splint should be checked and modified if necessary. In line with other forms of severe subluxation,

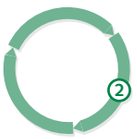
splinting for these injuries would normally vary from 1 week to 2 weeks. Splinting for longer periods with rigid splints should normally be avoided as this may increase the risk of ankylosis.[4] The benefit of antibiotic treatment is unproven and their use is governed by clinical judgment and preference.

4. Follow-Up Management



4.1 Root Canal Therapy
In view of the very high risk of loss of pulpal vitality, root canal treatment is often indicated in cases of severe intrusion. There is a high risk of root resorption in these teeth. The optimum time to enter the root canal is approximately 2 weeks after injury and following thorough mechanical cleaning and debridement, calcium hydroxide paste should be placed in the canal. In severely intruded teeth this early endodontic treatment is facilitated by rapid repositioning. Placement of calcium hydroxide in severely intruded teeth may inhibit root resorption and its use in cases where apical development is incomplete, should induce apical barrier formation. Maintenance of calcium hydroxide paste in the root canals for 6-12 months (with appropriate replacement as required) is advised, prior to the final obturation of the root canal.

These cases should be kept under regular review on a 6 monthly basis with occurrences of root resorption being noted and managed appropriately. Ankylosis as evidenced by disappearance of the periodontal space with fusion of root surface and bone and is an unfavourable sign.

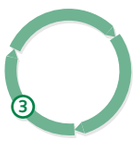


EXPLANATORY NOTES

The optimal treatment for intruded permanent teeth is not yet clear.[4] Treated cases of intruded incisor teeth have not been reported frequently enough nor with sufficiently high numbers for definitive protocols to be developed.[5,6] The largest series were 25 teeth reported from Scandinavia[7,8] and 29 cases reported from Belfast.[9] In these reports there was a high experience of loss of vitality and there was also a high prevalence of progressive root resorption. In addition loss of marginal bone support was also cited as a complication in a significant number of cases. Data on the survival of intruded teeth is scant although the Belfast study indicated that 20 out of 29 were retained after a 2 year period. The nature of the intrusion injury is somewhat unique. In cases of severe intrusion the degree of bony dilatation and displacement of the labial plate is quite marked and soft tissue tears in the superficial gingiva and mucosa are common. In the case of the severely intruded and buried incisor tooth, the degree of movement of the apex and apical vessels is 6mm or more and consequently there is a high risk of pulpal necrosis. In addition damage to the marginal bone is a risk and marginal bone defects are found to be present in between a quarter and half of all cases.[8,9] The nature of the crush injury to the periodontal membrane and root surface is quite severe and progressive root resorption is commonly seen, the figures varying from 38 per cent to 52 per cent.[8,9]

2.1 Teeth with incomplete root development will often re-erupt spontaneously.[4,8,10,11] Some authors advocate gingival surgery to provide early access for root canal treatment in order to prevent development of infection following pulpal necrosis.[11,12] and they report satisfactory spontaneous eruption provided periapical infection is treated promptly. Orthodontic extrusion is described as an option where the degree of intrusion is more substantial.[4] Turley et al investigated spontaneous re-eruption and orthodontic extrusions as options for experimentally intruded permanent teeth in dogs. While less severely intruded and mobile teeth responded well to orthodontic extrusion, deeply embedded teeth became ankylosed and failed to respond to orthodontic extrusion. He suggested that elective luxation and surgical repositioning of ankylosed teeth may facilitate orthodontic extrusion in some cases.[13,14] If intruded permanent incisors are managed conservatively there is a risk of such ankylosis.

2.2 Traditionally many authors advocate a cautious approach and suggest they be allowed to re-erupt [6,7] and others suggest that surgical repositioning may increase the risk of loss of marginal bone support.[4] It is important that the tooth should be sufficiently repositioned within three weeks to allow treatment of necrotic pulps and thus minimise the risk of inflammatory root resorption.[4,12] For mature incisors Andreasen advocates rapid orthodontic movement of such teeth over a two to three week period and if the crown is completely buried (equivalent to our severe classification) he suggests partial repositioning to allow orthodontic bracket fixation and subsequent full repositioning via the orthodontic method.[4] However the Belfast study indicated that full surgical repositioning of severely intruded teeth was not associated with an increased experience of root resorption or marginal sequestration of bone.[9] Unlike other forms of injuries long term prognosis seems to be positively related to the degree of apical closure and root development i.e. the best prognosis is seen in teeth where root development is most complete.[9]



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CONTINUING ORAL CARE - REVIEW AND RECALL

INTRODUCTION

Although the commonest oral disease of childhood is dental caries the dental role should encompass the whole of oral care for children. The aims of such care are firstly to ensure that all children are free from pain, sepsis and the destruction of dental tissues; secondly, to monitor the developing dentition; thirdly, to support children and their families in forming good oral health habits, practices and behaviours which can be carried forward into adulthood.

This care should be provided for both those children who are able-bodied and those who have impairment, be they physical, mental, medical, social or emotional.

The cornerstone of preventive care is professional supervision. Continuing care, review and recall are an essential part of that supervision and these guidelines should be read in conjunction with other such, relating to particular items.

Review is defined as an attendance at a further appointment within a course of treatment.

Recall is defined as the planned, unprecipitated return of a patient who, when last seen was in good oral health.

MANAGEMENT

1. Review and recall frequency

Recommendations:

1.1 In initiating the continuing care process, there should be no lower age limit to the first visit for a child which should, if possible, be within the first year of life.

1.2 There is considerable debate, with little factual basis, regarding the cost benefit of a specified recall period. There is such variation in the circumstances pertaining to an individual child that social, rather than medical, conventions probably have a greater importance in setting such a standard. In this context, there should be a recall at least once a year; 6 months is a convenient interval which provides for continuity of care. A proportion of child patients, for whom underlying conditions make additional demands, or local disease is progressing rapidly, will need to be seen at intervals far shorter than this at the clinician's discretion.

2. Variations in recall frequency

Recommendations:

2.1 Milestones in dental development (e.g. the expected eruption of particular primary and permanent teeth, the detection of displaced permanent canine teeth) should trigger recall in children under regular care. There is merit in the concept of specific "age milestones" at 3, 6, 9 and 12 years.

2.2 Particular attention should be paid to the eruptive sequence of teeth, especially with regard to symmetry, or whether an individual tooth is more than 6 months delayed.

2.3 Where a child shows obvious signs of active oral disease or its predisposing factors - a high level of individual or family previous decay experience, poor oral hygiene, enamel demineralisation, high sugar intake - review at not greater than four-monthly intervals is required until the factors are controlled.

2.4 Specific oral conditions (e.g. periodontal disease, other soft tissue disease, eruptive disorders, developmental dental conditions, dental injuries) will require attendance at variable intervals. Readers are referred to the guidelines for those specific conditions.

2.5 Compromised children should be seen on review or recall at intervals directly related to the severity of their underlying impairment and the oral findings.

3. The nature of the review and recall processes

Recommendations:

3.1 Wherever possible, recall and review should be to the same clinician.

3.2 Recall or review should give adequate time to establish child confidence and compliance, to update findings and to reinforce preventive instruction where required.

3.3 Records should be maintained in a standardised manner and stored in a recoverable form to make comparison easy and realistic.

EXPLANATORY NOTES

2. Children inevitably change in stature, in psyche and in what they eat and drink throughout the fifteen years from infancy to adolescence. Specific social, medical, oral or dental conditions will modify the period of attendance for either review or recall. Provision must be made for variation in the frequency of appointments in response to these pressures. Radiography is of importance in the assessment of disease progress and the reader is referred to the guideline on that subject.

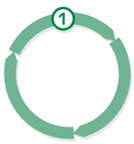
3. Review and recall should give the patient or the carer both the time and the opportunity to present any changes in their situation since the last visit and to discuss the progress of their condition. It should permit the clinician time to carry out a clinical examination (sic), to determine patient compliance with any previous prescription, to make adequate record of progress and to reinforce preventive advice (vide the guideline Prevention of dental caries for Children).

MANAGEMENT AND ROOT CANAL TREATMENT OF NON-VITAL IMMATURE PERMANENT INCISOR TEETH

INTRODUCTION

According to the 1994 Child Dental Health Survey[1] children have a one in five chance of traumatising their immature permanent incisor teeth (for definition see explanatory note 1). It is likely that 6 per cent of these teeth will become non vital and require endodontic treatment,[2] the aim of which is to obturate the root canal especially the apical third but not to go through the apex (explanatory note 2). However, it has been shown that root canal treatment of these teeth is seldom of an adequate standard. Indeed a recent report from the NW of England showed that 92 per cent of root treated permanent incisor teeth in children and adolescents were considered to be unsatisfactory.[3]

The successful management of non vital immature incisor teeth requires accurate diagnosis, appropriate emergency treatment, a meticulous endodontic technique and regular follow up. It is mandatory to keep good records (explanatory note 3).



1. INITIAL MANAGEMENT

1.1 Diagnosis of non vital immature permanent incisor tooth.

Before commencing endodontic treatment it is essential to determine whether the pulp is non-vital. This diagnosis is based on signs and symptoms, radiographic examination and the results of sensibility testing. (These are detailed in explanatory note 4.) If there is any uncertainty about the viability of the pulp, endodontic treatment should not be undertaken. The tooth should be reviewed regularly at either 3 or 6 months, and the special tests repeated.

1.2 Emergency Visit

Some patients may present as an emergency with pain and/or swelling. Ideally at this first visit the first full stage of endodontic treatment should be undertaken (see 1.3.1). However, time constraints or an acutely tender tooth may necessitate emergency measures. These may include:-

- prescription of antibiotics and/or analgesics.
- establishment of drainage through the tooth (see 1.2.1).
- arranging an appointment in 24 - 48 hours.
- sedative dressing (see 1.2.2).

1.2.1 Open drainage

The only justification for leaving a tooth on open drainage is if pus is discharging out of the access cavity. In these instances the tooth should be left on open drainage for not more than 48 hours because "superinfection" from the oral cavity can exacerbate the problem.

1.2.2 Sedative dressing

If vital tissue is encountered in the root canal and adequate anaesthesia can not be obtained to allow extirpation of the pulp a sedative dressing, such as Ledermix, can be sealed into the root canal. At the next visit local anaesthesia is usually successful, allowing full extirpation of the pulp.

1.3 Clinical Technique

1.3.1 Commencement of root canal treatment - visit 1.

- *Rubber dam.* It is preferable that the airway is protected with rubber dam. If the tooth has an extensive coronal fracture or is very tender to touch, the "split dam" or "trough" technique can still be used.

- *Access cavity.* This must be of sufficient size to allow instrumentation of the root canal but not be so large that it weakens the tooth at the cervical area.

- *Extirpation of the pulp.* Barbed broaches can be used, often two or more broaches used simultaneously are needed to twist and engage the pulp. If there is sensitive tissue in the apical portion of the root local anaesthesia will be required to extirpate the pulp fully.

- *Estimation of full working length.* The full working length, 1-2mm short of the apex, should be determined.

- *Preparation of root canal.* Repeated filing in tandem with irrigation of the root canal with saline or sodium hypochlorite is required to remove all necrotic debris. Reamers are of no value in immature incisor teeth (explanatory note 5).

- *Dry the root canal.* The root canal should be dried to its full working length using paper points.

- *Root canal dressing* (explanatory note 6). Calcium hydroxide paste is placed in the dry root canal to completely fill it to the apex. A cotton wool pledget in the access cavity is used to compress the paste to the apex. Seal the access cavity with a reinforced zinc oxide eugenol or glass ionomer cement.

- *Other root canal dressing materials* (explanatory note 7).

- *Use of disinfectants.* Intra canal disinfectant dressings are not needed. Filing, irrigation and filling of the root canal full with calcium hydroxide paste is usually sufficient to control infection.

1.3.2 Interim visits - usually the first at one month and then each 3 months.

- *Remove dressing.* Remove the cement and cotton

wool pledget. File and irrigate to remove the calcium hydroxide paste. Dry the canal.

● *Check for apical barrier* (explanatory note 8). Paper points placed up to apex are used to check for a calcific barrier. Radiographs are not indicated to check for the presence of a barrier as it can be felt using a paper point. If no barrier is detected redress root canal with calcium hydroxide paste. If a barrier completely closes the apex there is no evidence of periapical pathology or active root resorption, obturate with gutta percha and sealer.

● *Large periapical radiolucency*. If the tooth has a large periapical radiolucency it is wise to wait until there is definite evidence on follow up radiographs of bony healing before the final GP root filling is placed.

● *Persistent infection.* Check carefully that the root canal is clear of debris and that there is no foreign material such as a cotton wool pledget at the apex.

1.3.3 *GP root filling* (explanatory note 9). This may be accomplished using an appropriate root canal sealer, master GP point and lateral condensation of accessory GP points. If it is seen that the root canal walls are divergent towards the apex the master GP point can be inverted so that the wide end contacts against the apical barrier. After placement of the root filling a check radiograph is taken immediately. If the root filling is deficient it must be modified until satisfactory or removed and repeated.

Some clinicians prefer to fabricate a custom made GP point by rolling GP points together after heat softening. Injection of heated GP may also be employed.

1.3.4 *Final restoration.* Remove GP from the coronal pulp chamber as far as the cemento-enamel junction and fill the access cavity with glass ionomer cement. Acid etch composite is used as the final seal for the access cavity.

1.3.5 *Follow up visits.* Check for symptoms. Take a periapical radiograph to check for periapical pathology. Also check adjacent teeth as they may have been damaged in the original trauma. Traumatised teeth should be followed up for 2-3 years following the initial trauma. Radiograph at 6 monthly intervals for the first two years.

2. Restoration of Tooth

Root filled immature incisor teeth are poor candidates for posts and/or crowns. Acid etch composite and/or veneers are the treatment of choice.

3. Periradicular Surgery

Endodontic treatment and root end closure should be attempted before apicectomy. Apicectomy and/or periradicular curettage is the last resort when a tooth with a completely satisfactory root filling which could not be improved upon by redo-ing the filling, shows a periapical radiolucency which has increased in size.

4. Success Rate

Apical closure can be expected to occur in over 90 per cent of non vital immature incisor teeth treated by intracanal dressings of calcium hydroxide paste.[4,5] The five year success rate is over 85 per cent for teeth with adequate root fillings.[6]

Failures are usually due to poor root canal therapy, inadequate coronal seal or further trauma of a tooth with an adequate root canal treatment.

EXPLANATORY NOTES

1. Definition of an Immature Permanent Incisor Tooth

An immature permanent incisor tooth is defined as one where the apex can be considered to be open. Root canal treatment of these teeth requires a root end closure technique to form a complete calcific barrier at the apex of the tooth, against which a GP root filling can be condensed without the possibility of sealant or GP going through the apex into the periapical tissues.

2. Aim of Root Canal Treatment of Non-vital Immature Permanent Incisor Teeth

The removal of the necrotic pulp from the tooth and control of infection in the root canal. The use of calcium hydroxide paste in the root canal to produce a calcific barrier to completely occlude the open apex. Placement of a gutta percha root filling with sealer to completely obturate the root canal.

3. Record Keeping

The majority of non vital immature permanent incisor teeth are as a result of trauma. Claims against insurance policies and litigation are on the increase. It is therefore important that accurate records are made of the history, examination, diagnostic tests and treatment given in case of future legal action.

4. Diagnosis of Non-vital Immature Permanent Incisor Teeth

Diagnosis of the status of the pulp in previously traumatised incisor teeth can often be difficult. There can be a very real diagnostic dilemma. The nerve supply to the tooth may have been damaged but the pulp can still be alive because it has a vital blood supply. This has been demonstrated in laser doppler studies, where the pulp has been shown to be healthy but the tooth has not responded to traditional sensibility tests.[7]

Therefore, before embarking on root canal treatment of immature permanent incisor teeth the operator has to be certain that the pulp is necrotic. A negative response to traditional vitality tests must not be the sole reason for opening up a pulp chamber. The operator needs to consider the

history (including previous episodes of trauma) together with all the symptoms, signs and special test results:-

4.1 *Previous History:* *Trauma. Treatment.*

4.2 *Symptoms.* *History of pulpitis. Continuous pain. Tooth tender to bite on. Tooth loose. Swelling.*

4.3 *Signs.* *Swelling. Sinus. Crown darkening in colour. Increased mobility. Tooth tender to pressure.*

4.4 *Sensibility tests.* *Ethyl chloride. Electric pulp test. Hot GP.*

4.5 *Radiographs.* *Periapical radiolucency. Arrest of root development when compared with antimere.*

If there is doubt about the status of the pulp it is unwise to drill a test cavity in the palatal surface of the tooth. It is more appropriate to leave the tooth and reassess it at review.

5. Preparation of the Root Canal

Files are the instruments of choice. The root canals of immature incisor teeth are usually ovoid in shape and have thin root walls. The aim is to clean the root canal walls of debris, not to "shape" the root canal. Thus reamers are not indicated.

Filing should be carried out with caution to prevent excessive removal of dentine from the thin root canal walls. In addition, the files should not pass through the open apex into the apical area so as to avoid damaging any healthy apical tissues.

Filing should be alternated with copious irrigation to wash out the debris. The recommended irrigants are either saline or sodium hypochlorite. If sodium hypochlorite is used care must be taken so that it does not go into the apical tissues, and the final irrigation of the root canal should be with saline so as to remove any hypochlorite from the root canal.

6. Root Canal Dressing

The dry root canal should be filled with a calcium hydroxide paste.[8,9,10] The aim here is to fill the root canal completely with the paste. After introducing the paste into the root canal a lentulo spiral filler set to the full working length can be used to spin the paste up the root canal to the apical area.

When the canal is full of paste a cotton wool pledget is gently placed into the access cavity to compress the paste against the apical tissues. The pledget is left in the coronal portion of the pulp chamber to act as a dry base onto which the temporary seal can be placed into the access cavity. This could be a reinforced zinc oxide eugenol dressing or glass ionomer cement.

7. Other Root Canal Dressing Materials

Other root canal dressing materials have been advocated. Polyantibiotic pastes,[11] various antiseptics[12] and disinfectants have been recommended to control infection in the root canal but the scientific evidence to back up their use is lacking.

8. Check for Apical Barrier

Paper points can be gently advanced along a dry root canal. When the apex is reached the paper point will either impact against a solid barrier or press onto soft granulation tissue.

If a barrier is present the paper point can be tapped against the barrier and the patient will not feel it. The paper point end will remain dry.

If the barrier is not yet formed the paper point will press against soft spongy granulation tissue and this will be felt by the patient. The end of the paper point will be wet with tissue fluid or blood. The root canal should be redressed with calcium hydroxide paste and left for a further 3 months.

The average time to achieve apical closure is 6 months entailing 3 visits.[13]

9. Root Filling Techniques

The aim of the root filling is to completely obturate the root canal. Instead of the lateral condensation of GP points other methods of filling the root canal with gutta percha may be employed, these include constructing a custom GP point[14] or use of one of the heated gutta percha techniques. The method to be employed will be dependent upon operator preference and expertise.

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SECTION 2

Paediatric Dentistry Clinical Guidelines - RCS approved - ie Multi-disciplinary FDS approved Guidelines not yet published in International Journal of Paediatric Dentistry.

1. Diagnosis and Prevention of Dental Erosion - Draft Authors L Shaw and E O'Sullivan.

2. Stainless Steel Pre-formed Crowns for Primary Molars - Draft Author S A Fayle.

3. Management of the Stained Fissure in the First Permanent Molar - Draft Author J Smallridge.

4. The Pulp Treatment of the Primary Dentition - Draft Author D R Lewellyn.

DIAGNOSIS AND PREVENTION OF DENTAL EROSION

INTRODUCTION

Tooth wear is becoming more commonly recognised in both adults and children. The triad of attrition, abrasion and erosion has been known for many years, but the contribution of erosion to tooth surface loss may be increasing. Dental erosion is the irreversible loss of dental hard tissue due to a chemical process not involving bacteria, and not directly associated with mechanical or traumatic factors, or with dental caries. It is, however, fair to say that erosion usually co-exists with attrition and abrasion, but that one of these three factors is often more significant than the other two. Although there are no longitudinal studies on the prevalence of dental erosion, the UK Child Dental Health Survey of 1993 showed that 52 per cent of 5 year olds had significant erosion[1].

The following guidelines are intended to be of assistance to practitioners in the diagnosis and management of erosion in children and young people. This may be complex and require interdisciplinary long term treatment and liaison with physicians. Further details are available under "Explanatory Notes".

AETIOLOGY

It is essential that the aetiology of erosion is identified as the clinical management of the patient is based on management of the aetiological factors before definitive restorative care is undertaken. Erosion is undoubtedly a multifactorial process but the pattern of tooth tissue loss may give some clues as to the most important of the aetiological factors. All acids, whether from within the body or from external sources, are capable of de-mineralising tooth tissue and therefore of causing erosion.

1. Intrinsic Acidic Sources

These are essentially of gastric acid origin and enter the mouth from gastric reflux, vomiting or rumination.

1.1 Gastric Reflux

Gastro-oesophageal reflux is more common than previously thought 2,3,4 (see Table 1).

Table 1

Principal Causes of Gastro-Oesophageal Reflux
Sphincter incompetence - Oesophagitis - alcohol
- Hiatus hernia
- Pregnancy
- Diet
- Drugs e.g. Diazepam
- Neuromuscular e.g. Cerebral Palsy
Increased gastric pressure - Obesity
- Pregnancy
- Ascites
Increased gastric volume - After meals
- Obstruction
- Spasm

1.2 Vomiting

Vomiting may be spontaneous or self induced and may be associated with a variety of medical problems. (See Table 2 for the principal causes.) Current estimates suggest that the prevalence of anorexia and bulimia nervosa is increasing.

1.3 Rumination

This is an uncommon condition in which people deliberately induce reflux of a small amount of their gastric contents and chew this before re-swallowing. Several case reports have been published.[5]

2. Extrinsic Acid Sources

2.1 Environmental

Various sources of contact with acids as part of work or leisure activities have been reported.[6]

2.2 Dietary

Much emphasis has been placed on healthy food and drink in recent years and there is now good evidence that dietary practices and habits are changing.[7] This is particularly the case in relation to the consumption of soft drinks[8] with a considerable increase in quantity and change in age distribution.[8,9,10,11,12] Some alcoholic drinks, such as dry wines and alcopops are also acidic.

However, it is not just the total consumption of acidic dietary sources that is important but also the periodicity and relationship to toothbrushing practices (see Explanatory Notes).[12,13,14]

2.3 Medication and Oral Hygiene products

A number of common medications, such as Vitamin C tablets and iron preparations are very acidic as well as some proprietary mouthwashes.[15,16]

2.4 Lifestyle

Changes in general lifestyle have increased exposure to extrinsic acidic sources.[17,18]

Table 2

Principal causes of vomiting

Psychosomatic - Stress induced psychogenic vomiting

- Eating disorders
- Bulimia nervosa
- Anorexia nervosa

Metabolic and Endocrine

- Uraemia
- Diabetes
- Pregnancy

Gastro-intestinal disorders

- Peptic ulcer, gastritis
- Obstruction
- Nervous system disorders
- Encephalitis
- Cerebral palsy

Drug Induced

- Primary, e.g. Cytotoxics
- Secondary to gastric irritation e.g. Alcohol, Aspirin, Non Steroidal anti-inflammatory drugs

MANAGEMENT

Early diagnosis is important so that possible aetiological factors can be identified and preventive measures can be taken to halt further progression. Once the diagnosis has been made then it is essential to record accurately the severity and extent. This will enable any subsequent progression to be observed, and the effect of preventive measures assessed.

1. Recording Erosion

The most useful diagnostic index is the Tooth Wear Index (T.W.I) of Smith and Knight.[19] Study casts are essential and good clinical photographs helpful.

2. Dietary Analysis

Record at least a 3 day detailed diet history.

3. Dietary Counselling

This must be tailored to the individual.

3.1 Limit acidic foods and drinks to mealtimes.

3.2 Reduce frequency.[20]

3.3 Finish meals with alkaline foods.[21]

3.4 Avoid acid foods and drinks last thing at night.

3.5 Avoid toothbrushing after acidic substances.

3.6 Check the pH of medication, mouthwashes etc.

3.7 Chewing gum has been shown to stimulate salivary flow but may also cause increased gastric secretions.[22]

4. Intrinsic Acid Sources: Gastric Reflux and Vomiting

4.1 If there is evidence or suspicion then referral to the General Medical Practitioner and onwards to a Gastroenterologist or Psychiatrist may be required.

4.2 Anti reflux medication may be helpful. This should be prescribed in liaison with the General Medical Practitioner and/or Gastroenterologist. Omeprazole can be useful.

4.3 Following reflux, rinsing the mouth with water and sodium bicarbonate helps to neutralise the oral environment.

4.4 An occlusal guard containing sodium bicarbonate can be used at night if there is significant reflux at that time. (See Explanatory notes.)

5. Remineralisation and Desensitisation

5.1 Fluoride mouthrinses and varnish.

5.2 High fluoride level toothpaste.[23] (Caution in children under 6 years).

5.3 Low abrasive toothpaste.

5.4 Sugar free chewing gum.

5.5 Dentine bonding agents.

6. Restorative Treatment

Identify the problem first, covering eroded teeth may merely disguise the problem. Adhesive restorations in composite/compomers may be useful as an interim treatment. Adhesive metal castings and porcelain veneers may be used later.[24,25,26,27]

EXPLANATORY NOTES

Aetiology

1. Intrinsic Acidic Sources

1.1 Gastric Reflux

Gastro-oesophageal reflux is common in the Western World and it has been stated to affect 7 per cent of the adult population on a daily basis and one third every few days.[2]

However, there is a wide spectrum of disease from totally asymptomatic reflux to severe inflammation and ulceration of the oesophageal mucosa. There is also a wide spectrum of severity of reflux into the mouth but sometimes erosion of the dental tissues may be the first sign that reflux is occurring.

An in-depth study of 36 adults with palatal dental erosion of unclear aetiology showed that

gastro-oesophageal reflux was strongly associated with dental erosion and suggested that patients presenting with palatal dental erosion of uncertain cause should be investigated for reflux even in the absence of clinical symptoms.[3]

Signs and symptoms associated with reflux are heartburn, retrosternal discomfort, epigastric pain, and dysphagia (including odynophagia - pain on swallowing, particularly of hot liquids).

It has been found that neurologically impaired children have significantly higher levels of gastro-oesophageal reflux than "normal" children. Indeed, over 70 per cent of children with cerebral palsy have been found to have abnormal reflux activity.[4]

If reflux continues from the oesophagus into the mouth this is known as regurgitation. This is therefore the passive or effortless return of stomach contents into the mouth, unlike vomiting which is a physiologic response to recognised stimuli controlled by the autonomic nervous system.

There are many potential causes of reflux, some of them uncommon in childhood: the principal ones are shown in Table 1.

1.2 Vomiting

Vomiting may be spontaneous or self induced and may be associated with a variety of medical problems. (See Table 2 for the principal causes.) More emphasis has recently been placed on the eating disorders of anorexia and bulimia nervosa (the self-induced vomiting in bulimia nervosa may cause extensive erosion of the palatal aspects of upper incisors and molar teeth).

Current estimates suggest that the prevalence of these disorders is increasing. Bulimia nervosa affects between 1 and 4 per cent of white females between 18 and 30 years in the USA. Most bulimics either approximate to a normal weight range for their height and age or are grossly overweight. Anorexia is less common, affecting between 0.5 and 1 per cent of white females of 11-18 years of age. Most anorexics are well below their ideal body weight, this is achieved by starving and abstinence and/or vomiting.

Patients with eating disorders frequently brush their teeth after each vomiting episode - which increases tooth abrasion. Although it is often relatively easy for dental personnel to recognise these disorders, initiation of medical help is a sensitive undertaking.

Other conditions causing vomiting may also occur in conjunction with gastric reflux to compound the problem. Alcohol will cause both reflux and vomiting and additionally may itself be acidic giving both intrinsic and extrinsic acidic challenge to the teeth! Obviously all these conditions need to be operant over a lengthy period of time to potentially cause erosive problems.

2. Extrinsic Acidic Sources

2.1 Environmental

Extrinsic sources include environmental causes such as contact with acids as part of work or leisure activities. Battery, dynamite and fertiliser factory workers, laboratory technicians, professional wine tasters and competitive swimmers have all been reported as having significant dental erosion.[6]

2.2 Dietary

Much emphasis has been placed on healthy food and drink in recent years and dietary habits are apparently changing.[7]

Consumption of soft drinks has increased dramatically since the 1950s when they were first associated with tooth erosion in children. In 1950, 100 million litres of soft drinks were sold in the UK: this had increased sevenfold by 1990. This trend shows no indication of levelling off, indeed, the consumption in 1991 of 151 litres per head of population in the UK is still a long way behind the figure in the USA (263 litres in the same year).[8]

Mean consumption figures can hide important facts. Soft drink intake is much higher in younger age groups: soft drinks have been reported to provide as much as one-fifth of the added sugars in the diet of 11-12 year old children [9] *and 42 per cent of fruit drinks are consumed by children aged between 2 and 9 years. Frequency of, rather than total, intake may be critical in the erosive process. It is also the titratable acidity of the drinks that is more important in causing erosion than just the actual pH.*

Erosion may be particularly harmful to infants if drinks are taken over a prolonged period from a feeding bottle used as a comforter. There have been reports of extreme destruction resulting from abuse of fruit juices.[10]

It is apparent, therefore, that those most likely to show the affects of erosion in the dental tissues from excessive fruit drink intake are children. However, young people are taking the habit of having soft drinks with them into adult life rather than drinking tea or coffee. In 1995 it was projected that 12 to 25 year olds would be drinking 50 per cent more soft drinks by the year 2000.

A significant association between soft drink consumption and dental erosion was shown in an in-depth study of 101 children, mean age 8-9 years involving clinical examinations, dietary analysis and salivary flow and pH monitoring.[11] *There was also an association between bed-time consumption of fruit based drinks and the prevalence of dental erosion.*

A survey of UK pre-school children [11]*, involving a large diet and nutrition enquiry as well as oral health, also showed a weak relationship between the frequent consumption of sweetened drinks*

and carbonated beverages and dental erosion. It also confirmed the bed-time drink association.

Another important consideration is that dental erosion is frequently associated with individuals with high standards of oral hygiene [13] and it is likely that the bed-time drink may have occurred just before bed-time toothbrushing. The influence of oral hygiene practices is a significant complicating feature in the distribution of erosion. The effects of acid, whether from the diet or from the stomach, on softening the enamel and dentine may be compounded and modified by tooth brushing. If demineralised tissue is brushed, [14] even with a brush and water, abrasion accelerates until the demineralised layers are removed. The effects of repeatedly consuming acidic foods and drinks followed by tooth brushing are probably very important as far as erosion is concerned.

Erosion on its own causes much greater loss of tooth substance than abrasion alone, but the two in combination produce more destruction than can be accounted for by simply summing the effects. [13]

Although there is increasing evidence of the role of soft drinks in the development of erosion, it is not just drinks that contain acid. There are also other potential dietary sources such as fresh fruit, pickles and sauces, lactovegetarian foods and yoghurt.[11]

2.3 Medication and Oral Hygiene products

A number of common medications including vitamin C tablets and Iron preparations are also very acidic.

Vitamin C has been produced in a chewable tablet form which has been associated with extensive destruction when used to excess. [15]

Some mouthwashes and saliva substitutes have also been found to be very acidic, but now that the problem has been identified the mouthwashes have largely been reformulated.[16] Saliva substitutes with a low pH should be avoided in patients with natural teeth although there is little scientific evidence to support or refute that they have an influence on erosion.

2.4 Lifestyle

It is not just the total exposure to acidic substances that appears to have increased in recent years; there have also been changes in habits and general lifestyle. Undoubtedly there has been increased emphasis on a healthy diet and this involves a necessary increase in fruit and vegetable consumption. More people are becoming vegetarians, and this tends to be a more acidic diet.

The frequency of intake of food is changing with greater numbers of snacks being consumed and a reduction in the number of meals eaten at home. This is commonly known as "grazing". A habit of "frothing" up carbonated beverages in the mouth has also developed along with constant sipping from canned drinks.

Encouragement to take regular exercise plainly is of benefit to general health but excessive and frequent consumption of acidic sports drinks in some athletes has been shown to be a problem.[17]

Conversely there are unhealthy lifestyles that may be implicated in dental erosion. The use of the drug "Ecstasy" (3.4. Methylenedioxy-methamphetamine) reduces salivary flow. The dry mouth combined with dehydration from vigorous exercise and excessive consumption of low pH drinks has also been linked to dental erosion.[18]

Management

1. Recording Erosion

The most useful diagnostic index is the TWI of Smith and Knight.[19] However, good clinical photographs are helpful and study casts are essential. These should be accurate and produced in stone. When the patient returns for review a localised silicone rubber index is taken of the study cast in the areas of most concern. This can be cut through with a sharp scalpel over the area in question then transferred to be fitted onto the patient. If there is any gap between the silicone impression and the surface of the tooth then there has been further tooth wear. It is possible to use Scanning Electron Microscopy from replicas of the teeth but this is really a research procedure and not very practical clinically.

2. Dietary Analysis

A detailed diet history is vital. This can be done by getting the patient to keep an accurate 3 day diet diary but stressing that the time over which consumption occurred should also be recorded. Specific questioning about such habits as sipping, swishing, frothing and holding drinks in the mouth should be undertaken. Erosion caused by an excess of acidic food and drink commonly affects the labial and palatal surfaces of upper anterior teeth. These surfaces (sites where food and drink take longest to clear) are particularly at risk, whereas the lower incisor region (which is subjected to increased salivary washing and buffering) clears relatively quickly.[28] Factors such as how the drink is administered may influence erosion: drinks taken from a glass take longer to clear from the mouth than those consumed using a straw or a child's feeder cup.

Apart from food and drink, any other substances that pass through the mouth should be inquired about. Medication and oral hygiene products and practices are particularly relevant.[16]

3. Dietary Counselling

Counselling can only be given after the diet has been thoroughly assessed. It must be tailored to the individual on a positive basis to maximise compliance.

Specific points to emphasise are the limitation of acidic foods and drinks to mealtimes. This is the time of maximum salivary flow and increased buffering capacity.

Although there is huge individual variation in these parameters it is really not practicable to increase salivary flow and buffering capacity by drug control. It has been suggested, and there is some scientific evidence for this,[22] that the use of chewing gum is helpful in increasing salivary flow and encouraging tooth remineralisation. Finishing a meal with something to neutralise any acids, for example with a little cheese or milk, is also useful.[21]

Along with restriction of acidic substances to meal times should be advice to reduce the total amount and frequency of consumption. It has been shown that there is a rapid intra-oral drop in pH at the surface of the enamel following an acidic challenge and this comes back to resting pH levels only slowly.[20] Therefore, for example, frequent sips of an acidic drink will maintain the pH at a low level over a long period of time.

Patients should be advised to avoid acidic food and drink between meals and particularly last thing at night. There is a marked circadian rhythm to salivary flow and the flow rate is negligible at night during sleep.

Avoidance of tooth cleaning immediately after an acid challenge should also be advised.[14] It would be more sensible to clean the teeth with a fluoride toothpaste before that meal or to delay tooth-brushing.

4. Intrinsic Acid Sources: Gastric Reflux and Vomiting

If there is evidence, or suspicion, of gastric reflux or vomiting activity then contact should be made with the patient's General Medical Practitioner outlining the problem. Referral to a Gastro-enterologist for investigation and treatment may be desirable,[3] and those suffering from eating disorders usually need psychiatric help.

If acid from the stomach is repeatedly entering the patient's mouth they should be advised to rinse out with water or sodium bicarbonate and avoid tooth cleaning at this time.

An occlusal guard may be necessary if the patient has long term problems or if there is significant reflux activity at night, particularly if combined with parafunction. A small amount of sodium bicarbonate can be placed in the guard. Evidence for the effectiveness of this is extremely limited and great caution should be exercised in the construction of this device in case the buffer should leak out, and regurgitated acid become trapped beneath the guard overlying the tooth structure.

5. Remineralisation and Desensitisation

Patients with significant erosion and dentine exposure may complain of tooth sensitivity. This can be a serious problem to control. The use of fluoride mouthrinses and fluoride varnishes is helpful but they must be used frequently and regularly. A high fluoride content toothpaste, 1450 p.p.m, is also sensible as long as it is not also highly abrasive.[23] The use of a sugar free chewing gum has already been mentioned.

In patients with refractory sensitivity, dentine bonding agents can help to alleviate the symptoms. Although glass ionomer restorations, with high levels of leachable fluoride, may seem very applicable, their acid solubility is also high and retention may therefore be a problem. Compomers may be a useful alternative.

6. Restorative Treatment

Without doubt it is important to identify the problems first and try to address the aetiological factors before proceeding with complex restorative techniques. Covering eroded teeth without addressing the basic cause merely disguises the situation, but leaving surfaces unrestored may lead to further tooth surface loss. It may be impossible to completely eliminate some aetiological factors and withholding active therapy in some patients may lead to more complex restorative treatment having to be carried out later. Significant palatal dental erosion is irreversible and time consuming and expensive to restore on a long term basis. Adhesive metal castings and porcelain veneers have been used to good effect [24,25, 26,27] but careful and regular review of such restorations should be undertaken to ensure that erosive damage is not occuring around the periphery, rendering it highly susceptible to recurrent caries. Preventive programmes must remain the cornerstone of management of dental erosion.

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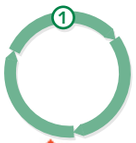
STAINLESS STEEL PRE-FORMED CROWNS FOR PRIMARY MOLARS

INTRODUCTION

Stainless steel (pre-formed) crowns are prefabricated crown forms which can be adapted to individual primary molars and cemented in place to provide a definitive restoration. The following guideline is intended to assist in the planning and provision of stainless steel crown restorations for primary molars.



1. Indications

Stainless steel crowns are the restoration of choice in the following situations:

1.1 Restoration of carious primary molars where more than two surfaces are affected, or where extensive one or two surface caries is present.

1.2 Following pulpotomy or pulpectomy procedures.

Stainless steel crowns may also be indicated in the following situations:

1.3 Restoration of primary molars affected by localised or generalised developmental problems (e.g. enamel hypoplasia, amelogenesis imperfecta, Dentinogenesis imperfecta etc.)

1.4 Restoration of fractured primary molars.

1.5 Restoration and protection of teeth exhibiting extensive tooth surface loss due to attrition, abrasion or erosion.

1.6 In patients with a high caries susceptibility.

1.7 As an abutment for certain appliances, such as space maintainers.

1.8 In patients where routine oral hygiene measures are impaired and breakdown of intra-coronal restorations is likely.

2. Clinical Procedure

2.1 Appropriate local analgesia should be obtained and the tooth should be isolated, preferably with rubber dam.

2.2 Caries removal and appropriate pulp treatment (i.e. indirect pulp capping, pulpotomy or pulpectomy) should be completed if necessary.

2.3 Appropriate tooth preparation should be carried out, which should include sufficient occlusal reduction to avoid significant occlusal prematurity, and approximal reduction to allow the crown to be seated beyond the maximum bulbosity of the crown. The preparation should finish with a smooth feather edge cervically with no step or shoulder. Where a primary molar has no adjacent tooth either mesially or distally it is still important to carry out approximal reduction to avoid producing an excessive marginal overhang. This is particularly important on the distal surface of second primary molars where such overhangs can impede the eruption of the first permanent molar. Buccal and lingual preparation is not always necessary and may be detrimental to retention.

2.4 A crown should be selected that is a tight snap fit. Choosing the correct size is assisted by measuring the mesio-distal dimension of the tooth, or contralateral tooth, with dividers.

2.5 Stainless steel crowns produced by several different manufacturers are available in the United Kingdom. The degree of adjustment necessary to achieve a satisfactory fit is very dependent upon the make of crown used. Nichro crowns (3M) are anatomically trimmed and contoured cervically and in many instances require little or no modification. Other types have little or no cervical contouring and hence routinely require modification.

2.5.1 If excessively long, the margin of the crown may impede complete seating of the crown, in which case the length of the crown may be adjusted by trimming with crown shears and re-smoothing and polishing the edges with an abrasive. Although it has been customary to recommend trimming of crowns where any gingival blanching occurs, there is no evidence that this practice reduces post cementation complications.

2.5.2 Over trimming of the crown margin should be avoided, as this may affect retention if it results in reduced adaptation of the crown margin into undercut areas. It is essential that the margins of the crown are well adapted into undercut areas, and this is usually achieved by crimping of the crown edges.

2.5.3 Special attention should be given to adaptation of the distal margin on second primary molars where the permanent molar is unerupted. Uncorrected distal overhang may result in impaction of first permanent molars.

2.6 Frequently, reduction in the mesio-distal dimension of the crown will be necessary, especially where mesial drift has resulted in loss of arch length. Moderate reduction in mesio-distal dimension can be achieved by flattening of the mesial and distal contact areas of the crown with Adam's pattern pliers. Other forms of modification, including vertically slicing one aspect of the crown and spot-welding additional segments of stainless steel band to increase the perimeter or extend the length have been described, but their efficacy remains largely untested.

2.7 Excessive occlusal interference should be avoided (greater than 1.0-1.5 mm), but a slightly premature or high occlusal contact is normally well tolerated (unlike permanent teeth).

2.8 The crown should be cemented with a luting cement. Glass ionomer or zinc polycarboxylate cements are widely advocated. However, there is some evidence suggesting that the specific choice of cement does not significantly affect retention, the most important retentive components being derived from correct contouring and crimping of the crown.

2.9 Careful attention should be paid to removal of excess cement. This can usually be effectively achieved by running a pointed instrument around the margins of the cemented crown and by passing knotted dental floss bucco-lingually through the contact areas prior to the cement setting. Excess cement has been shown to be subsequently detrimental to gingival health.

3. Other Considerations

3.1 Stainless steel crowns may be aesthetically improved by placement of composite resin in a buccal window cut into the labial face of the crown post-fitting. Crowns with prefabricated tooth coloured buccal facings are available from specialist suppliers.

3.2 When cementing orthodontic bands to stainless steel crowns roughening of the internal surface of the band and external surface of the crown prior to cementation has been shown to improve retention.

EXPLANATORY NOTES

1. *Stainless steel crowns are widely recognised as the most effective and durable restoration for primary molars. There have been several retrospective studies examining the longevity of stainless steel crowns in comparison with amalgam restorations.[1,2,3] All have shown stainless steel crowns to have markedly superior longevity when compared with multi-surface amalgam restorations. A more recent prospective study comparing stainless steel crown restorations with amalgam restorations in paired control teeth in the patients has been published which again demonstrated that the stainless steel crowns had superior longevity and required replacement less frequently.[4] Although no prospective studies have directly compared stainless steel crowns with primary molar restorations other than amalgam, retrospective data suggests that stainless steel crowns similarly out-perform glass ionomer cements and composite restorations.[5]*

2.3 *A study by Rector et al [13] failed to demonstrate that the type of tooth preparation affected retention. However, in an earlier study [14] preparations maintaining the greatest amount of buccal and lingual tooth structure were most retentive. This suggests that buccal and lingual reduction does not have any advantage with regard to retention and may even be detrimental.*

2.5.1 *Studies have failed to show any increase in supra-gingival plaque accumulation associated with stainless steel crowns.[6,7,8] However, crowns with defective margins, or where excess cement has been retained have been shown to be associated with an increased degree of plaque accumulation.[9,10] Several studies have investigated gingival health in association with stainless steel crown restorations. Two have suggested higher levels of gingivitis around teeth restored with stainless steel crowns.[10],[11] In both these studies, however, no direct comparison was made with unrestored matched control teeth. In two further studies where matched control teeth were used no difference in the level of gingivitis around stainless steel crowns was demonstrated.[7,8] The relationship between gingivitis and marginal defects, such as poor marginal adaptation and incomplete removal of excess cement, has been clearly demonstrated by several workers.[6,7,8,9,10] Careful adaptation of crown margins before fitting is essential and the incidence of post-fitting gingivitis may be reduced by careful polishing of the crown margin.[12]*

2.5.2 *It has been demonstrated that close adaptation of the metal margins of the crown in the undercut areas significantly enhances retention.[13]*

2.5.3 *The impaction of first permanent molars beneath over-hanging distal margins on poorly adapted stainless steel crowns have been reported.[20] Therefore, careful attention should be paid to adaptation of the distal margin on second primary molars where the permanent molar is unerupted.*

2.7 *Slightly premature or high occlusal contact is normally well tolerated (unlike permanent teeth) and clinically appears to be compensated for within a few weeks by adaptation of the dento-alveolar complex.*

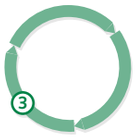
2.8 *A study comparing stainless steel crown retention with polycarboxylate and glass ionomer cement failed to demonstrate any difference[15], and in an extensive study which demonstrated a 92 per cent five-year survival[13] the majority of crowns were cemented using a reinforced zinc oxide cement. Choice of cement would therefore appear to be non-critical.*

2.9 *Where excess cement has been retained, stainless steel crowns have been shown to be associated with an increased degree of plaque accumulation.[9,10] The relationship between gingivitis and marginal defects, such as poor marginal adaptation and incomplete removal of excess cement, has been clearly demonstrated by several workers.[6,7,8,9,10.]*

3.1 *The aesthetic improvement of the appearance of stainless steel crowns by placement of composite resin in a buccal window cut into the labial face of the crown post-fitting has been reported.[16,17] In one report[16] the restoration was followed to exfoliation 23 months later, without evidence of deterioration. Crowns with prefabricated tooth coloured buccal facings are available from specialist suppliers.*

3.2 *Orthodontic band retention on stainless steel*

crowns has been shown to be poorer than on unrestored teeth. Roughening of the internal surface of the band and external surface of the crown prior to cementation has been shown to improve retention strength to a level comparable with those obtained on unrestored permanent molar and premolar teeth.[19]



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AUTHOR'S NOTE

Several of the expert panel felt that the term "Preformed metal crown" should be used instead of "Stainless steel crown". Whilst I can see the rationale behind this suggestion, I have not changed the guideline at this stage for the following reasons:

- the current 3M nichro SSCs ARE made of stainless steel - I checked this with 3M.
- the entire literature on the subject uses the term "stainless steel crowns".
- there are other pre-formed metal crowns other than primary molar SSCs eg. ion aluminium temporary crowns.

In spite of this, if the expert panel feels that the terminology should be changed, I am happy to do so. I would welcome feedback on this issue.

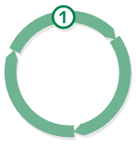
MANAGEMENT OF THE STAINED FISSURE IN THE FIRST PERMANENT MOLAR

INTRODUCTION

The occlusal surface of the first permanent molar is the tooth surface most vulnerable to dental decay[1] For many years there has been a marked decline in the levels of dental decay found in children's teeth. This trend has continued throughout the period 1973-1993 and has been noted in many countries. However, as the overall caries level drops the proportion of the caries that is accounted for by occlusal pit and fissure caries rises.[1-5] This appears to be true regardless of the reason for the reduction.

The following guideline is intended to assist with the management of the first permanent molar where the fissure is stained rendering the diagnosis for that surface less clear.

A stained fissure is taken to mean a fissure which is discoloured, brown or black. Also included are fissures where there is an area of white or opaque enamel, i.e. its normal translucency is lost but which has no evidence of surface breakdown (cavitation). Where diagnosis is definite, treatment decisions are straightforward, i.e. where a tooth is newly erupted and the fissure system is untainted but considered at risk from caries, fissure sealing is recommended (BSPD policy document on fissure sealants).[6] Where there is occlusal cavitation it is synonymous with an extensive lesion therefore a restorative approach is recommended.[7] However it should be remembered that precavitated lesions in the pit and fissures are about twice as frequent as cavitated lesions.[8]



1. DIAGNOSIS OF THE STAINED FISSURE.

Several methods of diagnosis have been proposed both alone and in combination.

1.1 Visual [dry tooth]
1.2 Probe/explorer[9,10]
1.3 Bitewing radiographs[11, 12,13]
1.4 Electronic[14-17].
1.5 Fibre Optic Transillumination (FOTI [18])
1.6 CO2 laser [19]
1.7 Air abrasion[20]

When two or three methods are used in combination, there is a greater accuracy and higher detection of caries.[15,18,21,22]

A minimum should consist of the use of visual examination and bitewing radiography. It is essential that the tooth is dried thoroughly to permit study of the colour and translucency of the enamel.

See Additional Considerations for prediction of progress of caries.

2. TREATMENT

2.1 Where the diagnostic methods, visual inspection and bitewings have established that a stained fissure is a carious lesion into dentine, restorative treatment is indicated. This can take the form of a preventive resin restoration (PRR)/sealant restoration (SR)[23,24,25] or if the lesion proves more extensive, then composite or amalgam occlusal restoration.

2.1.1 PRR/SR. For this, local analgesia and the use of rubber dam are desirable. Suspect areas of the fissure system are explored with a high speed small bur. In this procedure only enough enamel to gain access and the incipient caries is removed. (If the radiograph shows dentinal caries access must progress into dentine.) The access must be wide enough to ensure that the caries can be removed from the peripheral tissue. It is emphasised that undermined enamel is left in situ, since it has been shown that the bis GMA resin restoration virtually restores the original strength of the tooth. Line the cavity with a calcium hydroxide preparation, etch[26,29] (recommended times vary), wash,[27] dry and fill. If the resultant cavity is large, either a suitable dentine bonding agent and posterior composite, or a combination of an inner core of glass polyalkenoate and an outer shell of composite may be utilised. If composite alone is to be used then an incremental technique must be employed to achieve satisfactory polymerisation and resultant strength. If the cavity is small and not subject to occlusal load either the latter treatment method or glass polyalkenoate could be used.[30] It is important to seal all the remaining fissure system, and finally to check the occlusion.

2.1.2 Regular review of the surface sealant integrity is important (at routine 4 or 6 monthly intervals). Repeat etching of the occlusal surface will facilitate identification of sealant presence, if visual examination is inconclusive.[30,31,32,33]

Where diagnostic methods are inconclusive but indicate no definite signs of dentinal caries explore the fissure with a small round or a very fine short tapered bur (diamond or tungsten carbide). Either slow running handpiece or airotor have been advocated.

- If the lesion obviously progresses into dentine, proceed as above.

- If the lesion is confined to enamel, etch, wash and dry as before and place posterior composite if appropriate (i.e. consider final size of the exploratory cavity).

- Seal all the remaining fissure system.

- Monitor.

2.3 Where you are convinced that the discolouration is deemed to be purely staining and does not shield caries, fissure seal, and monitor regularly.

2.4 Where co-operation is inadequate to proceed

as above, the following approach is suggested:

C

2.4.1

- Fissure seal and inform the parent that caries is present.[33]
- that the tooth will need further treatment in the future.
- monitor at frequent intervals (it is more difficult to assess the severity of the lesion once it is sealed).[34]
- treat with PRR as and when co-operation improves.

B

- Where co-operation is minimal and it is impossible to obtain adequate moisture control to place conventional, but technique sensitive composite fissure sealant,
- place glass polyalkenoate over the fissure system.[36-42]
- apply regular fluoride varnish.[43]
- attempt to progress the treatment as circumstances change. It is imperative that in such treatment scheduling, the parents are kept fully informed and that appropriate dietary, oral hygiene and fluoride advice is reinforced.

All the above treatments utilise the preventive effect of sealing the fissure to prevent the ingress of bacteria and debris that facilitate caries.

3. ADDITIONAL CONSIDERATIONS

3.1

Because of the difficulty in diagnosing fissure caries, it follows that it is hard to quantify the extent of a lesion. Hence it is also arduous to accurately monitor the progress of any such lesion, just as it is problematic to predict the likely rate of progress and conversely the chances of remineralisation of any lesion. Researchers in one review[48] investigated the status of questionable fissures in permanent molars from other studies and found that after varying periods a large number of the studied teeth had become carious, i.e. progression of the lesion was more likely than not.

The studies looking at diagnosis of occlusal caries have shown that it is more likely that occlusal caries will go undetected rather than non carious surfaces filled. Therefore before considering treatment recommendations, factors must be considered that could influence the progress of caries and therefore help to predict the likely outcome of treatment options.

A

B

3.2

Although in the past sealing over known caries has been advocated as acceptable[44-46] it is not recommended as a definitive treatment because studies have revealed active cariogenic organisms and soft carious dentine even when marginal adaptation was assessed as good when viewed with scanning electron microscope (S.E.M). Coupled with the difficulty of attempting to assess the integrity of sealants clinically, the extent of the problem becomes apparent. Nearly 50 per cent of clinically apparently well sealed teeth have marginal defects on S.E.M. Added to this, the complexity of the problem is exacerbated by poor attendance.[47]

B

3.3 Age.

The younger the age of the patient exhibiting the stained fissure the greater the risk of caries progressing.[49]

3.4 Co-operation

All restorative treatment options need reasonable patient co-operation. Fissure sealing requires less co-operation. Procedures used only as a temporary measure to delay caries progression such as GIC over dubious areas or preventive measures such as fluoride varnish applications require the least co-operation from the child.

C

3.5 Findings on the other first permanent molars.

If the other first permanent molars exhibit cavitated lesions the stained fissure must be treated.

A

3.6 History of previous caries

It has been said that high levels of caries in the primary dentition is predictive of caries susceptibility in the permanent dentition. This is used as an indication for fissure sealing and should also be used to indicate need for active treatment of a stained fissure in a first permanent molar tooth.[50]

A

3.7 Dietary considerations

The relationship between frequent sucrose intake and dental caries is well established.[51-54] Therefore in patients with a diet known to have more than three sugary intakes per day, it must be considered that caries is likely to progress and stained fissures should be treated. To investigate a diet, personal questioning and a diet history sheet will help to quantify the extent of refined carbohydrate ingestion.

3.8 Oral hygiene

Normal brushing always leaves some plaque in fissures, thus oral hygiene status does not have any definitive relationship with caries levels. Apart from the obvious benefit regular brushing entails in facilitating fluoride exposure, oral hygiene status cannot be used to predict likely progress of a stained fissure lesion.

In conclusion it follows that these techniques should all be mutually supportive such that the management of the stained fissure would incorporate a diagnosis made as accurately as possible with the methods available, investigation and treatment of the suspect area, as well as a dietary record and advice, oral hygiene instruction, appropriate fluoride advice and sealing of all potentially vulnerable sites.

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THE PULP TREATMENT OF THE PRIMARY DENTITION

INTRODUCTION

The most common cause of pulpal exposure is caries, but it may occur during cavity preparation or as a result of erosion or fracture of the crown. Pulpal exposures secondary to caries are more common in primary teeth due to the relatively large size of the pulp chambers. Following pulpal exposures, infection may occur and this results in pulpal inflammation and commonly necrosis. This does not always lead to pain, as the inflammation can remain subacute or chronic, but the situation may become acute at any time.

Primary teeth with pulpal exposures should always be treated and this takes the form of either pulp treatment or extraction. If extractions are undertaken consideration should then be given to space maintenance and balancing and compensating extractions.

1. INDICATIONS AND CONTRA-INDICATIONS FOR RETAINING THE PRIMARY DENTITION

Indications

1.1 Where a primary tooth is to be conserved rather than extracted, pulp treatment is indicated:

- where the patient exhibits signs and symptoms of pulpitis, either reversible or irreversible

- where the interproximal marginal ridge has been lost secondary to caries

- where there is radiographic evidence of caries extending more than half way from the Amelo-dentinal junction to the pulp

- where there are clinical signs of pulpal necrosis.

1.2 Patients for whom extraction of primary teeth should be avoided:

- Medical e.g. haemophilia or other bleeding diatheses, diabetes where a general anaesthetic is to be avoided.

- Patient compliance - previous unhappy experience of tooth extraction - the patient here may find pulp treatment preferable and less stressful.

- Primary dentition in which all the molars are present or where space maintenance has prevented loss of arch dimension.

- Dentitions in which there is shortage of space - tooth loss here would lead to further crowding of the permanent successors.

- Retention of primary teeth when there is no permanent successor.

- Maintenance of masticatory function.

- Aesthetics.

Contra-indications

1.3 Patients for whom pulp treatments are not advised or contraindicated:

- A patient who has previously failed to comply with dental treatment.

- A patient whose family background precludes pulp treatment i.e. an unfavourable attitude towards dental treatment.

- Medical problems - patients whose general health is at risk from transient bacteraemias e.g. children with congenital heart disease and those who are immunocompromised either due to primary disease (e.g. hypogammaglobulinaemia) or medical treatment (Oncology patients and Transplant recipients).

- A poorly cared for dentition in which multiple extractions are necessary - usually considered to be more than 2 or 3 teeth in need of pulp treatments.

- Mixed dentitions in which there is mild to moderate shortage of space, particularly in the incisors. Here balanced loss of the first primary molars may be justified. This will probably result in the extractions of premolars at a later stage. Primary second molars should be retained if at all possible to prevent mesial drift of the first permanent molars on eruption.

- A grossly broken down primary molar, where there is insufficient tooth tissue remaining for a viable coronal restoration.

- A tooth with caries penetrating the floor of the pulp chamber.

- A tooth close to exfoliation (i.e. with less than two thirds of root length remaining).

- A tooth with advanced pathological root resorption.

2. MANAGEMENT

2.1 Preparation

Local anaesthesia should be attained and where possible the tooth isolated with rubber dam.

2.2 Indirect Pulp Capping

The aim here is to maintain the vitality of the pulp by placing a dressing indirectly on a thin layer of dentine.

The most commonly used medicament for indirect pulp capping is calcium hydroxide as it stimulates secondary dentine formation. The prognosis for

indirect pulp capping is good, whereas direct pulp capping of carious exposures in primary teeth carries a poor prognosis, with internal resorption being a frequent sequel.

C

Other medicaments have been suggested instead of calcium hydroxide e.g. antibiotic pastes and anti-inflammatory drugs. Some success has been reported, but the eventual development of pulp necrosis and abscess formation tend to occur, often without symptoms.

B

Recent research has suggested that adhesive dental materials and bonding agents may be suitable for indirect pulp capping in permanent teeth. Their efficacy in primary teeth remains untested.

2.3 Direct Pulp Capping

B

Direct pulp capping aims to maintain pulpal vitality by direct placement of a material, usually calcium hydroxide, in contact with the coronal pulp. For cariously exposed primary molars the vital pulpotomy technique is preferred, as the success of direct pulp capping in these teeth has been shown to be inferior.

2.4 Pulpotomy

B

A pulpotomy is the procedure of removing the coronal portion of the pulp tissue, with the aim of removing all infected or inflamed tissue, but leaving a vital radicular pulp. It is indicated where there is a carious pulp exposure, with or without signs or symptoms of pulpitis, but where the radicular pulp remains vital and uninflamed.

A pulpotomy is performed on vital teeth with carious pulp exposures deemed unsuitable for pulp capping. Primary molars with loss of more than $^{2}/_{3}$rds of the marginal ridge usually require a pulpotomy, as the coronal pulp in these teeth is often irreversibly inflamed.

2.4.1 There are 3 pulpotomy techniques:-

a. Vital Formocresol Pulpotomy Technique - also known as the "five minute formocresol pulpotomy" and the "one stage" pulpotomy - here the coronal pulp is removed after adequate analgesia and the vital radicular pulp stumps are treated with formocresol.

b. Devitalisation Pulpotomy - this is a two stage technique and relies upon paraformaldehyde to fix the coronal and radicular pulp tissue.

c. Non-Vital Pulpotomy - this technique is carried out when the inflammatory process affecting the coronal pulp extends to the radicular pulp leading to an irreversible change in the pulp tissue.

It is essential to obtain analgesia prior to removal of caries and the coronal pulp. This usually means an inferior dental nerve block for lower teeth, an infiltration is adequate for upper molars. All the caries is removed and the cavity is extended so that the entire roof of the coronal pulp chamber is breached. A large excavator or a sterile large rosehead bur is used to remove the coronal pulp tissue and the haemorrhage is controlled by pressure from sterile cotton wool pledgets. A small pledget of cotton wool dipped in a 1:5 dilution of Buckley's formocresol and squeezed to remove excess liquid is placed over the radicular pulp stumps for four to five minutes. This pledget is then removed and if the haemorrhage has stopped, the pulp chamber is filled with a hard setting glass ionomer or zinc oxide eugenol cement and the tooth restored, preferably with a preformed metal crown, as the crown of a tooth after such a pulpotomy is weak and may fracture.

Follow up of the pulpotomised tooth should be regular and annual radiographs advisable to check on the furcation area. Rarefaction of bone in this area signifies failure and a pulpectomy or extraction may be needed.

2.4.2 Devitalisation Pulpotomy

This is a two stage procedure and relies upon the use of paraformaldehyde to fix (mummify) the coronal and radicular pulp tissue.

B

This technique carries a lower success rate than the formocresol vital pulpotomy, but may be useful where adequate local analgesia for pulpal extirpation cannot be obtained. The paraformaldehyde paste is placed over the pulpal exposure on a small pledget of cotton wool, the larger the exposure then the more successful the outcome. Formaldehyde vapour liberated from the paraformaldehyde permeates through the coronal and radicular pulp, fixing the tissues. The paraformaldehyde paste is sealed into the cavity with a thin mix of zinc oxide eugenol and left for 1-2 weeks. At the second visit, the dressing is removed, there is no need to administer a local anaesthetic as the pulp contents should be non-vital, the pulp remnants should be excavated leaving the radicular pulp stumps. These are then covered with hard setting zinc oxide cement or, alternatively, an antiseptic dressing (equal parts of eugenol and formocresol with zinc oxide) and the cavity filled with a hard setting cement base and restored.

2.4.3 Non-Vital Pulpotomy

B

This technique has been advocated when the inflammatory process affecting the coronal pulp extends to the radicular pulp leading to an irreversible change in the pulp tissue. Another application for this technique is when the pulp is completely non-vital,where there may be an abscess present with or without acute cellulitis. However, only limited data are available relating to this technique and this indicates a low success rate (approximately 50 per cent).

Technique

lst visit
The necrotic coronal pulp is first removed, as recommended in the vital pulpotomy technique, the necrotic debris in the pulp chamber is then cleared. If there is sufficient access to the radicular pulp

canals then as much as possible of the necrotic tissue is removed with a small excavator. A small pledget of cotton wool dipped in beechwood creosote solution is then placed over the pulp stumps after removing excess solution by dabbing on a sterile cotton roll. The beechwood creosote is then sealed into the cavity with a temporary zinc oxide eugenol cement.

2nd visit
Usually 1-2 weeks later the dressing is removed, provided the signs and symptoms of infection have cleared i.e. any sinus present is resolving, there has been no pain and no mobility of the tooth. The cavity is then restored in the same manner as used in the vital pulpotomy technique. However, if it appears that there is no resolution of the symptoms then the beechwood creosote should be replaced for a further 1-2 weeks.

2.5 Pulpectomy

Pulpectomy is indicated where the radicular pulp is irreversibly inflamed or has lost vitality.

This technique is often considered impracticable because of the difficulty in obtaining adequate access to the root canals and because of the complexity of root canals in primary molars. The canals are ribbon shaped and may have several inter communicating canals. However, more recent retrospective clinical studies have demonstrated a relatively high success rate.

Technique

The coronal pulp is removed as for the vital pulpotomy technique, the pulp may be necrotic or showing irreversible inflammation as evidenced by persistent bleeding even after a four minute application of formocresol. Depending on the state of the pulp i.e. irreversibly inflamed or necrotic, then a one or two stage technique is described.

2.5.1 One Stage Technique

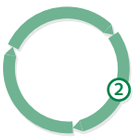
The root canals are identified, they usually have the same number of canals as permanent molars and they are then cleared out with files to within one or two millimetres of the apex. The canals are filed lightly, as the roots are fragile: reamers are not used as this may result in damage to the roots. Filings should be to no more than size 30. The root canals are then dried with paper points. Formocresol may be placed over the root canals for four minutes. Pure zinc oxide and eugenol is then mixed into a slurry and carried into the root canals with a spiral root canal filler. The rest of the pulp chamber is then restored as for the previous pulpotomy technique and appropriate follow up appointments are made.

2.5.2 Two Stage Technique

Visit 1
The necrotic pulp contents are removed, any fistula can be punctured to enhance drainage if necessary.

The root canals are filed and irrigated and the pulp dressed with formocresol on a pledget of cotton wool, the cavity is sealed with zinc oxide and eugenol for a week. Antibiotics are given if there is associated cellulitis.

Visit 2
The symptoms should have resolved and the tooth treated as for the one stage technique.



EXPLANATORY NOTES

1.1 *Statistically direct pulp capping has been found to be less successful in primary teeth than indirect pulp therapy or coronal amputation (pulpotomy). The highest success rates have been obtained in teeth with non carious exposures and no signs of pre-existing pulpal inflammation. Success in cariously exposed primary teeth is poor.*

1.2 Formocresol

Constituents of Buckley's formocresol

Tricresol	*35 per cent*
Formaldehyde	*19 per cent*
Glycerol	*15 per cent*
Water	*31 per cent*

A dilution of this formulation 1 in 5 has been shown to be equally as effective and less toxic. This 1:5 dilution is now advocated by most authorities. Other medicaments have been evaluated as an alternative for the vital pulpotomy technique, but none have been shown to perform as well as formocresol.

1.3 Alternatives to formocresol

Glutaraldehyde has been suggested by S'Gravenmade as an alternative to formocresol. However, recent studies have demonstrated a similar or lower clinical success rate than formocresol and concerns about hypersensitivity reactions and the handling of glutaraldehyde mean it has few advocates as a replacement for formocresol. Calcium hydroxide has also been used as an alternative to formocresol, but its success has been poor compared with formocresol with marked internal resorption reported. Other reported techniques include electrosurgery, ferric sulphate and enriched collagen solution. The efficacy of these approaches awaits full evaluation.

1.4 Constituents of paraformaldehyde paste (mummifying paste)

Paraformaldehyde	*1 G*
Lignocaine	*0.06 G*
Carmine	*10.0 mg*
Propylene Glycol	*0.5 ml*
Carbowax 1500	*1.3 G*

1.5 Constituents of beechwood creosote

2 Methoxy, 4 methyl phenol (cresol)	*13 per cent*
0 - Methoxy phenol (guaicol)	*47 per cent*
M - Methoxy phenol	*7 per cent*
P - Methoxy phenol	*26 per cent*
Unknown	*7 per cent*

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Section 3

British Society of Paediatric Dentistry Policy Documents

Definition

1. Sugars and the Dental Health of Children (1992). Draft Author A Rugg-Gunn.

2. Toothfriendly Sweets (1995). Draft Authors S Williams, A Rugg-Gunn, D Gratrix and D Fung.

3. Sedation for Paediatric Dentistry (1996). Draft Authors G J Roberts, J Page and E S Davenport.

4. Fluoride Dietary Supplements and Fluoride Toothpastes for Children (1996). Draft Authors R D Holt, J H Nunn, W P Rock and J Page.

5. Dental Needs of Children (1997). Draft Authors J H Nunn, P Crawford, J Page and G Winter.

Definition:

Policy documents produced by the British Society of Paediatric Dentistry represent the majority view of the membership and are based on a consideration of the available evidence at the time of production. They are produced to provide guidance with a clear intention that the policy be regularly reviewed and updated to take account of changing views and developments.

This section contains five such documents produced since 1992.

SUGARS AND THE DENTAL HEALTH OF CHILDREN

International Journal of Paediatric Dentistry 1992; 2: 177-180. First published 1992.

This policy document was prepared and approved by the BSPD by Professor A. J. Rugg-Gunn

AUTHORITATIVE REVIEWS OF DIETARY SUGARS AS A CAUSE OF DENTAL CARIES

Evidence concerning the role of dietary sugars as a cause of dental caries has been reviewed by several non-commercial, authoritative bodies in the UK and worldwide. While recognising that dental caries is a multi-factorial disease, all agree that dietary sugars are the most important dietary cause of caries and urge a reduction in consumption of sugars.

The most important report was that by the Department of Health entitled "Dietary Sugars and Human Disease" [1]. It pointed out that staple starchy foods, intrinsic sugars in whole fruit and milk sugars are negligible causes of dental caries, but that caries experience is positively related to the amount of non-milk extrinsic sugars in the diet and the frequency of their consumption. The British Society of Paediatric Dentistry agrees with these conclusions. Advice given in the policy document of the Health Education Authority [2] entitled "The Scientific Basis of Dental Health Education" supports the above report. Last year, the Department of Health published a report on dietary reference values for the UK including, for the first time, recommendations for consumption levels of sugars and starches [3]. This report endorsed the Department of Health's 1989 report [1] on sugars and recommended that the population's consumption of non-milk extrinsic sugars should not exceed about 60 g/day or 10 per cent of total energy intake. For 10-year-old children (given that their estimated average requirement for energy is 7.76 MJ), 54 g of sucrose would supply 10 per cent of energy, on average; it is important to realise, though, that dietary reference values are formulated for groups, not individuals. Amounts of sugars in a few common foods are given in Table 1. A technical report published by the World Health Organisation [4] was in close agreement with the recommendations of the Department of Health [1,3].

Table 1. Typical amounts of non-milk extrinsic sugars in a few foods commonly eaten by children

	Non-milk extrinsic sugars(g)
170g packet of boiled sweets	150
170g packet of wine gum sweets	116
65g chocolate confectionery bar	40
200g packet of biscuits	72
Cup of tea with 2 teaspoons of sugar	10
330ml can of cola drink	35

A number of reports have looked specifically at dietary problems in children. The Committee on Medical Aspects of Food Policy [5] strongly criticised the use of bottles and reservoir feeders containing sugary drinks as comforters, and recommended that the use of reservoir feeders be abolished. This view, of the damage done to children's teeth by comforters containing sugary drinks, has been echoed by the Department of Health and Social Security. [6,7]

There is, thus, little doubt of an authoritative consensus that sugar consumption causes caries in children and that the level of consumption should be decreased. The British Society of Paediatric Dentistry fully supports these views which are based on extensive scientific evidence.

AREAS OF CONCERN IN THE ABUSE OF SUGARS BY CHILDREN

Infant feeding

Breast feeding is not a significant cause of dental caries in Britain. A very small number of cases have been reported of on-demand and prolonged (beyond the first year) breast feeding being associated with caries development, but these rare occurrences are not a valid reason for discouraging breast feeding. Epidemiological surveys reveal that children who are breast fed have less dental decay than those who were not breast-fed, but this difference is likely to be due to other favourable habits of mothers who breast feed [8].

Formula-feeds are not a cause of dental caries in Britain unless feeding takes place very frequently day and night, or unless sugar is added to the feed. Bovine milk does not cause dental caries unless sugar is added [8-10].

Sugared fruit-flavoured drinks are a cause of dental caries, especially when taken frequently and when used for prolonged periods as a comforter in a bottle or reservoir feeder [11]. Extensive (rampant) caries can develop very rapidly when such drinks are misused. The report of the Department of Health on "Present-Day Practice in Infant Feeding" (Third Report) [7] states that "infant drinks (are a) range of products designed to add flavouring to water" and that "thirsty infants will take water without flavouring." (Report paragraph 6.3).

Sugared medicines

Children often take medicines in a syrup form as it improves compliance. Some children have to take medicines several times during the day and night for long periods and, if those medicines contain sugar, the threat to the child's teeth is considerable [12]. The British Society of Paediatric Dentistry has expressed concern at the widespread use of sugar-containing liquid oral medicines. In many localities good co-operation between professionals has helped to limit this problem, but there is likely to be much unnecessary dental disease caused by the use of

sugar-containing medicines in this country. The proportion of liquid oral medicines that are non-sugar-based has increased, but is still less than 50 per cent. While many proprietary brands of liquid oral medicine are now available in a sugarfree form, very few generic medicines are sugarfree probably because of the extra cost involved. This is a cause of concern, as prescribing of generic drugs is actively encouraged.

SUGAR CONSUMPTION FROM FOODS AND DRINKS BY CHILDREN IN BRITAIN

About 20 per cent of energy intake in schoolchildren comes from dietary sugars. Over 70 per cent of these dietary sugars are non-milk extrinsic sugars. The report of the Department of Health on Dietary Reference Values [3] points out that these non-milk extrinsic sugars are nutritionally unnecessary and that they should contribute from zero but not more than 11 per cent of food energy intake. Over 80 per cent of non-milk extrinsic sugars in the diets of children comes from just four sources: confectionery, soft drinks, table sugar and biscuits/cakes [13]. By far the biggest source is confectionery, which is also often made and marketed for frequent eating. Not surprisingly these four major sources of non-milk extrinsic sugars are singled out in dental health education as important causes of dental caries. Eating of confectionery and biscuits begins at a young age and is often used as a means of pacifying children rather than as part of their diet [14,15].

Children of social groups IV and V consume more confectionery, biscuits and cakes and are more likely to add sugar to drinks and use bottles as comforters, than children of other social groups [11, 15]. These habits are also found in a high proportion of some groups of new immigrants [9,16]. A high proportion of children in these groups suffer from extensive caries at a young age.

BARRIERS TO REDUCING ABUSE OF SUGARS BY CHILDREN

Those who care for the dental health of children are concerned at the presence of considerable barriers to their efforts to reduce sugar consumption by children in the UK.

One important barrier is the extensive advertising of foods and drinks containing high levels of non-milk extrinsic sugars. Television advertising, in particular, when broadcast at times when children watch, contains a very large number of advertisements for high-sugar products. The amount of money spent by the confectionery industry alone on television advertising exceeds £100 million per year. The sum set aside by Government for dental health education to urge children to reduce sugar consumption is less than one per cent of this figure. This unequal balance is a formidable barrier to promotion of dental health in children.

A second barrier is the increasing sales of foods and drinks high in non-milk extrinsic sugars within schools, and the presence in schools of education material produced by The Sugar Bureau. The Society recognises the considerable financial pressures placed upon schools, but it believes both those activities to be against the health interests of children and to be in direct conflict with the promotion of health of children.

A third barrier is the refusal of the majority of confectionery manufacturers to label their products in accordance with Government guidelines (MAFF) and recommendations (DoH); these state that the sugar content of foods should be listed under Nutritional Information[17,18]. Inadequate labelling confuses purchasers and is a barrier to good nutrition.

PROMOTING THE DENTAL HEALTH OF CHILDREN

The Society welcomes the report "The Health of the Nation" published by the Department of Health, in July 1991. In the Foreword, the Secretary of State for Health said (page iv) that he wished to emphasise three points: first, that promotion of good health was of major importance; second, that changes in behaviour (including diet) were necessary; and, third, that targets for improvements in health should be set.

All three of these points are very relevant to prevention of dental decay in children by control of dietary sugars, and the Society wishes to continue to participate in the formulation and implementation of strategies for health of children.

SUMMARY AND RECOMMENDATIONS

1. The British Society of Paediatric Dentistry welcomes the commitment by the Secretary of State for Health to a preventive philosophy. The Society wishes to be consulted in formulating objectives for improving the dental health of children by dietary means, and considers the following points appropriate.

2. The Society agrees with the conclusions of the expert committees listed in this policy document which have consistently urged a reduction in sugars intake. Consumption of non-milk extrinsic sugars by children in the UK should be reduced to the proposed level of between zero and 11 per cent of food energy intake.

3. Health education is a central pillar of health promotion. The Society asks Government to resource health education at a level which will be adequate to ensure that the objectives for the health of children are met. The Society supports the work of the Health Education Authority but believes that its resources are presently quite inadequate for the task.

4. The Society urges Government to encourage promotion of good dietary habits in schools. It is concerned at the potential threat to the health of children of the use of sponsored teaching material. It believes the use of material sponsored by The Sugar Bureau is against the interests of dental health and that this material should be withdrawn. The

Society is concerned at the high proportion of schools which continue to sell confectionery and other foods and drinks high in non-milk extrinsic sugars, and urges Government and local education authorities to ensure that more suitable foods are promoted.

5. The Society asks Government to ensure that foods are properly labelled. This requires that the amount of sugars is listed under Nutrition Information according to MAFF category III format. Where sugars are listed in the Ingredients, the type and amount should be given. Food labelling regulations should permit foods to be labelled "safe for teeth" according to guidelines of the International Tooth Friendly Association and the British Dental Association.

6. The Society considers that advertisements of foods and drinks high in non-milk extrinsic sugars encourages children to consume these products at the expense of more nutritious foods. It urges Government to review the health issues concerning advertisements of foods and drinks, particularly on television, so that they do not threaten the health of children. Both the quantity of advertisements and the content of the advertisements should be considered. The Society believes that control by regulatory bodies has been inadequate. The Society is also concerned that sponsorship of programmes on television could be detrimental to health and asks Government to ensure that programme sponsorship is controlled so that there is no threat to the dental health of children.

The Society requests food retailers not to place confectionery at the check-out gates of their stores.

7. The addition of sugar to bottles is almost always unnecessary. The Society urges those who care for infants and young children, and those who advise parents, to ensure that parents are aware of the danger to teeth of the use of sugars in bottles and comforters.

8. The Society has expressed concern at the high proportion of liquid oral medicines that contain sugars. The Society urges Government to encourage availability of non-sugar alternatives, those prescribing and dispensing medicines to ensure that a non-sugared medicine is preferred, and the public, through health education, to demand non-sugar alternatives. The Society is aware that generic prescribing leads to greater use of sugar containing liquid oral medicines, and asks Government to consider ways of ensuring that non-sugar medicines are dispensed preferentially.

9. The Society urges Government to pursue an agricultural policy which encourages healthy eating habits and discourages unhealthy eating habits. Removal of subsidies on sugars and sugar production would be an important step in this direction.

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TOOTHFRIENDLY SWEETS

International Journal of Paediatric Dentistry 1995; 5: 195-197. First published 1995.

This policy document was prepared by Dr Sonia Williams in association with Professor Andrew Rugg-Gunn, Mrs Delphine Gratrix and Miss Diane Fung, and approved by the Council of the BSPD. The remit was to consider the value of "Toothfriendly Sweets" in improving the dental health of children.

DEFINITION

The term "Toothfriendly Sweets" refers to a selection of confectionery products which may contain a range of permitted, non-sugar sweeteners. These products are passed as "safe for teeth", qualifying for a "toothfriendly" logo, on the basis of a standard test in which the pH of plaque is measured in vivo by telemetry for 30 minutes during or after consumption of the product by healthy volunteers. The amount of potentially erosive food acid must not exceed a pre-set threshold value as measured by a plaque-free electrode. In the UK, the non-sugar sweeteners in use have been approved by the Department of Health (DoH) and Ministry of Agriculture, Fisheries and Food (MAFF).

BACKGROUND

The "toothfriendly" concept originated in Switzerland, where in 1982 the idea of the logo was developed. People came to recognize and identify the product, and the concept has since spread further, including Belgium, Germany, France and Japan. Following approval by the Council of the British Dental Association, the British Association of Toothfriendly Sweets (BATS) was launched in 1993, to inform dentists, manufacturers and then the public.

PHILOSOPHY

General

The importance of diet for health has been emphasised[1]. A reduction in the total amount of non-milk extinsic sugars as well as in the frequency of their consumption is proposed within dietary guidelines[2,3]. Dental health education must incorporate wise food choices for healthy living generally, which emphasize unrefined carbohydrates, moderate protein and low fat. Many high-sugar foods are also high in fat, and dentally orientated advice must take account of this. In the UK, confectionery provides one -third of all non-milk extrinsic sugars, and constitutes a substantial part of between-meal eating [4]. A substitution of sugars by alternatives such as 'toothfriendly sweets' provides one strategy towards this end.

EVIDENCE OF EFFECTIVENESS

(a) The raw ingredients are known to be non-cariogenic, or virtually so.

(b) Clinical trials have shown that "toothfriendly" products are associated with lower caries experience. This has been demonstrated as chewing gum in Finland[5,6] and Canada[7], and as confectionery in Hungary[8] and the South Pacific[9].

(c) In Switzerland, 'toothfriendly' products are chiefly consumed by children[10]. Although the Swiss confectionery market has remained more or less stable over the past 10 years, the sugar-free section has increased from 5 per cent to 20 per cent from 1982 to 1992. There, as in Finland where "toothfriendly" sweets have been used extensively, reductions in caries have mainly been ascribed to fluoride use. However, approximately 10 per cent is considered attributable to substitution with "toothfriendly" sweets[11].

(d) This evidence relates to countries outside the UK, and the practical benefits of the use of "toothfriendly" sweets in the UK are unknown, particularly in respect of the different socioeconomic and cultural mix.

HEALTH PROMOTION ISSUES

The special role of dentists and others. If "Toothfriendly Sweets" are to be effectively launched in the UK, the dental profession will need to understand and promote the concept of substitution of confectionery in the diet. When dentists are aware and supportive, they can encourage the public to sample them. The endorsement of other professional groups is also essential, all of whom would require ample explanation of the philosophy. Such groups include all members of the dental team, other health professionals (e.g. dieticians, health promotion, paediatricians, general practitioners), educational groups, including teachers, and Health Authorities, involving consultants in dental public health and public health medicine.

TARGETING INDIVIDUALS AND POPULATIONS

Those at high risk of developing caries can be reached in surgery - and community-based settings. High-risk individuals may be identified by their own dentists. However, it is important that the whole population becomes aware of "Toothfriendly Sweets". Opportunities for promotion may include influencing school tuck shops or kiosks in hospitals to substitute sugar-free confectionery for those on sale at present. Incentives to purchase could be developed (e.g. collect labels for logo badge), with educational packs promoted for schools to support tuck shop initiatives, and with activities to include targeting children with special needs. Ultimately, "toothfriendly" initiatives must be part of a total preventive package: the value of fluorides in caries prevention must also be emphasised.

HEALTH EDUCATION MESSAGES

Health education messages associated with "tooth-friendly sweets" have to be simple, taking account of the guidelines. These should include: "If you must have sweets, choose sugar-free varieties", "Look for the logo", "They taste good". Cost is an important issue. It is important that manufacturers' pricing policies do not present barriers. Parents also need to be encouraged to weigh up the balance between dental health and the cost of sweets.

FURTHER CONSIDERATIONS

(a) Manufacturers should be able to see advantages in going into this market. The dental profession may wish to support "toothfriendly sweets" on the basis of effectiveness, relative safety, variety and cost. Manufacturers will also be involved with technical details and the promotion of their image.

(b) The validity of the test has promoted discussion, in the light of the range of other tests available to establish "cariogenicity". However, there is no evidence so far that 'toothfriendly' products that have passed the test are harmful to dental health.

(c) Price is a crucial element. It might be difficult to compete with sugar-containing products. Costs of raw materials are probably the major potential cause of any differential between the "toothfriendly" product and alternative confectionery. In addition, manufacturers are subject to specific costs for accreditation involving testing, registration and a surcharge on the sales of each product. At present there are no UK laboratories accredited for these tests. Registration costs and surcharge go to the national agency promoting the logo. If "toothfriendly sweets" are not cheaper or as cheap as the alternative, there will be a strong disincentive for many vulnerable groups. Supportive action from Government regarding VAT exemption, as suggested by the BDA, could improve this situation. Manufacturers must feel that they will profit from using the "toothfriendly" logo.

(d) Symbiosis between manufacturer and the profession is an important element. While explaining the use of "toothfriendly" products to patients and the public, the dental profession can also highlight potential marketing opportunities. Unfortunately the present "toothfriendly" confectionery products do not cater for the very young, namely the toddler population. Among this group the damage associated with the consumption of confectionery may be well established before they are old enough to use 'toothfriendly' products, since "at-risk" children have often developed sweet-eating habits and a preference at an early age. They need to be offered alternatives to the type of confectionery they like.

(e) Limitations. The consumption of appreciable amounts of some artificial sweeteners can create a laxative effect, which limits the quantity which may be consumed. All artificial sweeteners used in the UK are passed by the DoH and MAFF, and there are no data suggesting harm (other than the laxative effect) in humans in normally-consumed doses.

RECOMMENDATIONS

1. The importance of a complete, healthy diet for children is recognised. Children must be encouraged to have an all-round healthy diet as outlined by Government reports.

2. In this context, "toothfriendly sweets" have a valuable role where dietary advice to reduce sweet snacks is difficult to achieve.

3. Although there are some limitations* to their use, "toothfriendly sweets" may be seen as an approach towards reducing consumption of non-milk extrinsic sugars, by substitution, especially for individuals or groups at high risk of developing dental caries.

4. Their use should be recommended in conjunction with well-established preventive measures (e.g. good oral hygiene practices, appropriate use of fluorides).

*They should be used in moderation because of potential gastrointestinal effects, and for this reason are not advised for very young children[12].

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SEDATION FOR PAEDIATRIC DENTISTRY

International Journal of Paediatric Dentistry 1996; 6: 63-66. First published 1996.

This document was prepared by G J Roberts, A H Brook, J Page and E S Davenport. Policy documents produced by the BSPD represent a majority view, based on a consideration of currently available evidence. They are produced to provide guidance, with the clear intention that the policy be regularly reviewed and updated to take account of changing views and developments.

INTRODUCTION

Despite advances in preventive dentistry, children sometimes have to undergo uncomfortable or painful treatment procedures. Although the total number of general anaesthetics for dentistry has reduced over the last 20 years [1], general anaesthesia is used more frequently than can be justified on clinical grounds. The risk of death [2] and the side-effects of general anaesthesia [3,4] are factors that should discourage its use before alternative techniques have been considered.

A safer yet often effective alternative to general anaesthesia is the use of sedation supplemented with local anaesthesia [5]. In recent years a number of documents have been published on sedation and anaesthesia in dentistry [6,7]. These have suffered from the shortcoming of not being directed specifically to the operator/sedationist working with children. Nevertheless they provide a valuable source of information for clinicians wishing to practise sedation.

It is the purpose of this document to make recommendations for the role of sedation in paediatric dentistry.

DEFINITION OF SEDATION

Sedation has been defined as "a state of depression of the central nervous system which reduces anxiety thus enabling treatment to be carried out satisfactorily. During sedation the patient will be able to independently maintain his airway, independently maintain an open mouth, and respond sensibly to verbal commands. In addition, the patient will retain adequate function of protective reflexes such as the laryngeal reflex. The drugs used should carry a margin of safety sufficient to render unintended loss of consciousness extremely unlikely" [6,8].

It is considered that there is no clear distinction between light and deep sedation as clinical entities, so these terms will not be used. Any technique which exceeds the above definition and in which verbal contact with the patient is lost is unsuitable for use by the operator/sedationist, ie. where the clinician carrying out the treatment is also acting as the sedationist. To practise sedation, the clinician must have training in sedative techniques and be accompanied by a suitably trained dental nurse [9].

The practice of the operator acting as his/her own sedationist is now regarded as good clinical practice provided that suitable guidelines are followed [7].

AIMS AND OBJECTIVES OF SEDATION

The aims of sedation are to reduce anxiety and improve co-operation, thus enabling treatment to be satisfactorily completed without resorting to general anaesthesia [10].

The objectives are:

(1) To enable the provision of quality dental care.
(2) To manage disruptive behaviour.
(3) To return the patient quickly to a physiologic state in which it is safe to return home.
(4) To produce a positive psychological response to dental treatment [11].

METHODS

There are five routes of administering a central nervous system depressant currently used, each of which has established methods that have been published in the dental and related literature [12]. These are oral sedation [13], inhalation sedation [14,15], intravenous sedation [10], intramuscular sedation [16], and rectal sedation [17].

ADVANTAGES AND DISADVANTAGES

The main advantages are the avoidance of general anaesthesia, the improvement in operating conditions, and the rehabilitation of dentally anxious children and adolescents [10]. Over a period of time, which may differ considerably for individual children, anxiety will be reduced and the patient able to accept treatment without the need for sedation.

The disadvantages of some techniques are the unpredictable outcome, need for supervised recovery, and close supervision at home for the remainder of the day of the operation.

EXPOSURE OF STAFF TO ANAESTHETIC GASES

There is evidence that chronic exposure to unscavenged anaesthetic gases, whether used for sedation or general anaesthesia, may lead to health problems such as reduced fecundability, although only when the exposure to unscavenged gases exceeds 5 hours per week [18,19]. The use of scavenging devices to remove nitrous oxide in the dental surgery reduces pollution to acceptable levels [19]. Whenever anaesthetic gases are used, effective scavenging must be available.

CLINICAL STRATEGY

The method of sedation should be chosen following a full and detailed dental and medical history. The

general principle to be followed is that all children should be treated using techniques that intrude minimally upon their physiological state. Prior to any operative treatment, unless severe pain or infection need to be treated, the patient should undergo a programme of preventive care. This would need to be integrated into the management plan for each child, for example reinforcement of preventive care during a period of respite or before extensive conservation under general anaesthesia.

When dental treatment is attempted there is a progression, from local anaesthesia alone as the safest technique, through sedation, with a small increase in risk, to general anaesthesia with which there is a finite risk of serious complications leading, on occasion, to death [2]. If an attempt at treatment using local anaesthesia or local anaesthesia with sedation is unsuccessful, the clinician should consider a respite period of, for example, 3 months. This will permit the parents and child to see the benefits of preventive care and give the child time to mature. General anaesthesia should only be proposed when all other options have been considered.

Once treatment is complete, the patient should be kept on regular recall so that further preventive care can be provided. A general strategy for coping with an anxious child is outlined in Fig. 1 on page 52.

CONSENT

It is essential to obtain consent for dental treatment and related procedures such as local anaesthesia and sedation. It is prudent to obtain this consent in writing. If such consent is obtained at the start of a course of treatment, it should indicate the likely number of visits and also the number of times and nature of any sedation. If there is a change of treatment plan during the course of treatment and further visits using sedation are required, then additional consent is required. It is not necessary to obtain written consent at every visit, but a separate consent form should be used for each course of treatment.

ASSESSMENT OF RISK DURING SEDATION AND OPERATIVE WORK

Patients who are to undergo sedation in general dental practice, community dental practice, or specialist practice should be ASA (American Society of Anesthesiologists) Class I or II. Children who are ASA Class III or IV ratings should be treated in a hospital setting. [20]

Class I: No organic, physiological, biochemical or psychiatric disturbance.
Class II: Mild to moderate systemic disturbance, e.g. mild diabetes, moderate anaemia, well-controlled asthma.
Class III: Severe systemic disease, e.g. severe diabetes with vascular complications, severe pulmonary insufficiency.
Class IV: Severe systemic disorders that are already life-threatening, e.g. signs of cardiac insufficiency.
Class V: The moribund patient who has little chance of survival without operative intervention.

UNEXPECTED LOSS OF CONSCIOUSNESS

All sedative techniques carry the risk of unexpected anaesthesia which could lead to loss of the airway and subsequent depression of respiratory and cardiovascular function. These risks arise because of a number of factors, including the following [20].

(1) The effects of the sedative drugs themselves, especially when used in combination with other drugs, including local analgesia.

(2) Administration of an excessive amount of the sedative drug.

(3) Individual variations in response to the drug being used.

(4) The varying ability, training and experience of the operator/sedationist and staff.

(5) Additional risks when treating patients with moderate to severe medical problems, especially when unusual combinations of drugs are being used.

If the patient unexpectedly loses consciousness, the dentist and his team should follow a carefully rehearsed routine to safeguard the patient's airway until he/she is awake (Appendix 1).

INSTRUCTIONS TO PATIENTS AND PARENTS

Specific verbal and written instructions should be given to patients and/or parents when children are to undergo a planned procedure for sedation. These will include directions about being accompanied, and about eating and drinking pre-operatively. The instructions must also include advice on caring for the patient following sedation.

ADDITIONAL PRECAUTIONS DURING RECOVERY FROM SEDATION

To ensure that the patient is sufficiently recovered following sedation, the child should be capable of drinking and retaining a small volume of fluid, responding verbally to questions, keeping his/her eyes open, and standing unassisted without swaying unduly.

The recommendations of the British Society of Paediatric Dentistry for dentists practising sedation

1. Patients must be fully assessed both medically and dentally before sedation is used.

2. Sedation is suitable for all age groups in paediatric dentistry.

3. There are no absolute contraindications to the use of sedation for paediatric dentistry. In general terms, patients in ASA Class I or II will usually be treated in general dental practice or the Community

Dental Service, and patients in ASA II or IV will almost always be treated in a hospital.

4. All dental surgeons should undergo appropriate training before using sedation. As techniques advance and improve, it is necessary for dental surgeons to ensure that they also undergo appropriate continuing education.

5. The dental team providing sedation must undergo resuscitation training at regular intervals not exceeding 1 year.

6. All equipment must be maintained to a satisfactory standard.

7. All drugs must be checked regularly for their shelf life, usually on a monthly basis.

8. All sedation procedures must be fully documented in the patient's notes.

9. Written consent must be obtained for the treatment and the sedation.

Appendix 1: Unexpected loss of consciousness

On the rare occasions when the patient becomes unconscious the dentist and his staff should adopt the following routine:

(1) Cease the operative procedure immediately.

(2) Ensure that the mouth is cleared of all fluids by using high-volume suction.

(3) Turn the patient onto his/her side in the "recovery" position.

(4) Consider administration of 100 per cent oxygen.

(5) Consider monitoring pulse, blood pressure, and respiration.

(6) Start resuscitation if necessary.

(7) Stay with the patient until full signs of being awake are present, i.e. eyes open, independent maintenance of the airway, and verbal contact [10].

(8) Follow-up of the patient by review within 3 days.

(9) Fully document the incident.

(10) Inform the patient's general medical practitioner of the incident.

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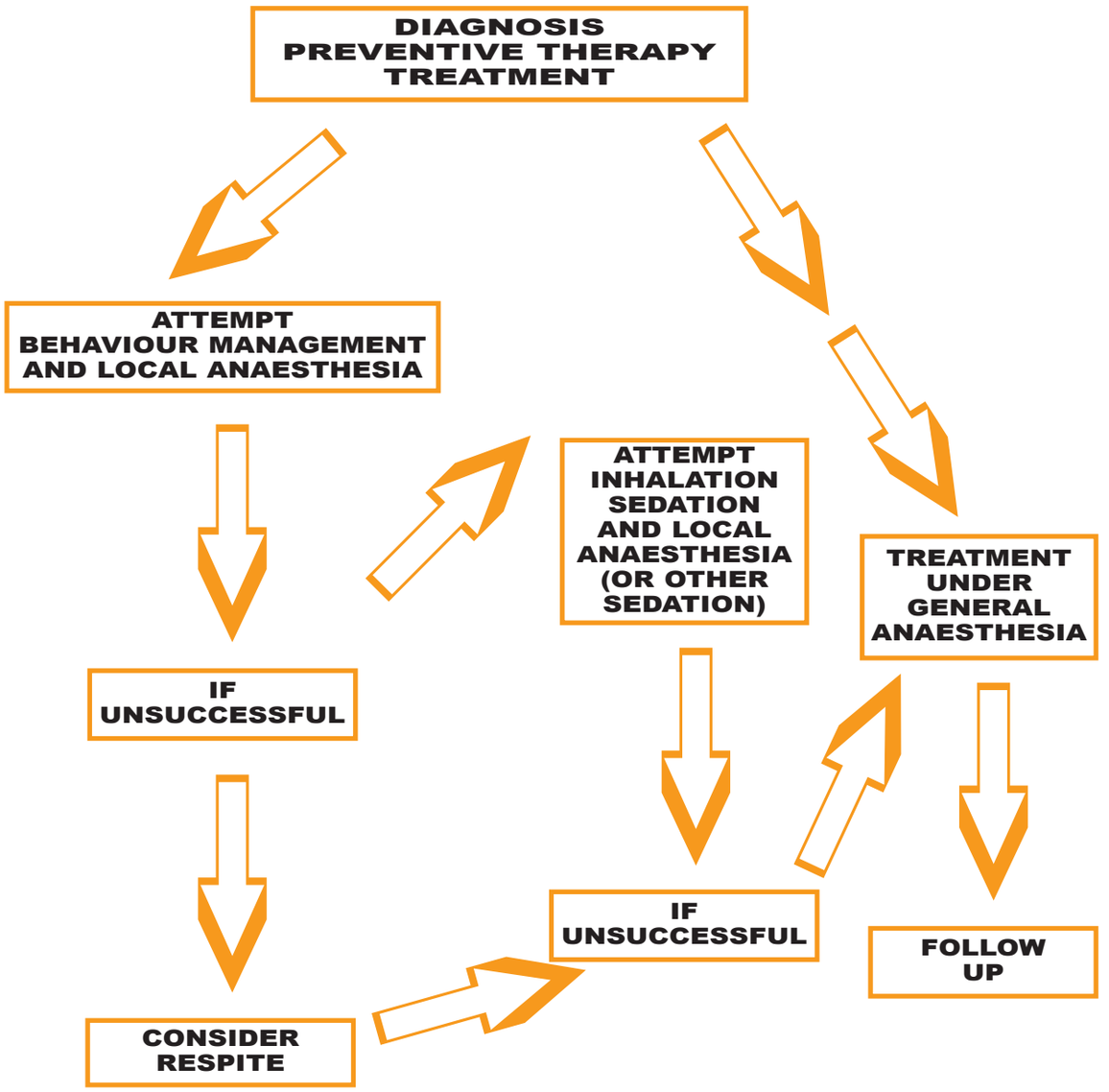
Fig. 1. General strategy for coping with an anxious child.



© 1996 IAPD and BSPD, *International Journal of Paediatric Dentistry* 6: 63-66.

FLUORIDE DIETARY SUPPLEMENTS AND FLUORIDE TOOTHPASTES FOR CHILDREN

International Journal of Paediatric Dentistry 1996; 6: 139-142.

This policy document was prepared by R D Holt, J H Nunn, W P Rock and J Page on behalf of the BSPD*. Policy documents produced by the BSPD represent a majority view, based on a consideration of currently available evidence. They are produced to provide guidance with the clear intention that the policy be regularly reviewed and updated to take account of changing views and developments.

INTRODUCTION

Water fluoridation is the most effective means of preventing caries in children [1]. Other means of fluoride use have been introduced [2], but in many areas of the UK failure to implement this measure means that fluoride has been mainly used as fluoride supplements and fluoride toothpastes. Both have come under particular scrutiny as a consequence of growing concern about enamel opacities resulting from too high a fluoride intake during tooth development. However, caries experience in many younger children has changed little over the last decade and the need for prevention remains [3].

FLUORIDE DIETARY SUPPLEMENTS

When introduced, dietary fluoride supplements were perceived to be a reasonable alternative where water fluoridation was not possible. They were regarded as valuable both for individuals and as a public health measure. More recently it has been concluded that the cariostatic effect of supplements may be less than was suggested in early trials [4,5]. The initial dosage schedules were introduced before fluoride toothpastes were widely available. They were set to emulate the effects of drinking 1000 ml of water fluoridated at 1 mg per litre [6], but it would appear that children rarely drink as much as half this amount [7]. More than one study has shown an association between use of fluoride supplements and enamel opacities [5]. Supplements also demand a high degree of cooperation over a long period [8-10] and it has been suggested that recommendations should not only be reduced but also simplified in order to encourage co-operation [11].

*The British Dental Association, The British Society of Paediatric Dentistry, The British Association for the Study of Community Dentistry, and manufacturers of fluoride supplements are currently working together to establish consistent and simplified dosage instructions for fluoride supplements.

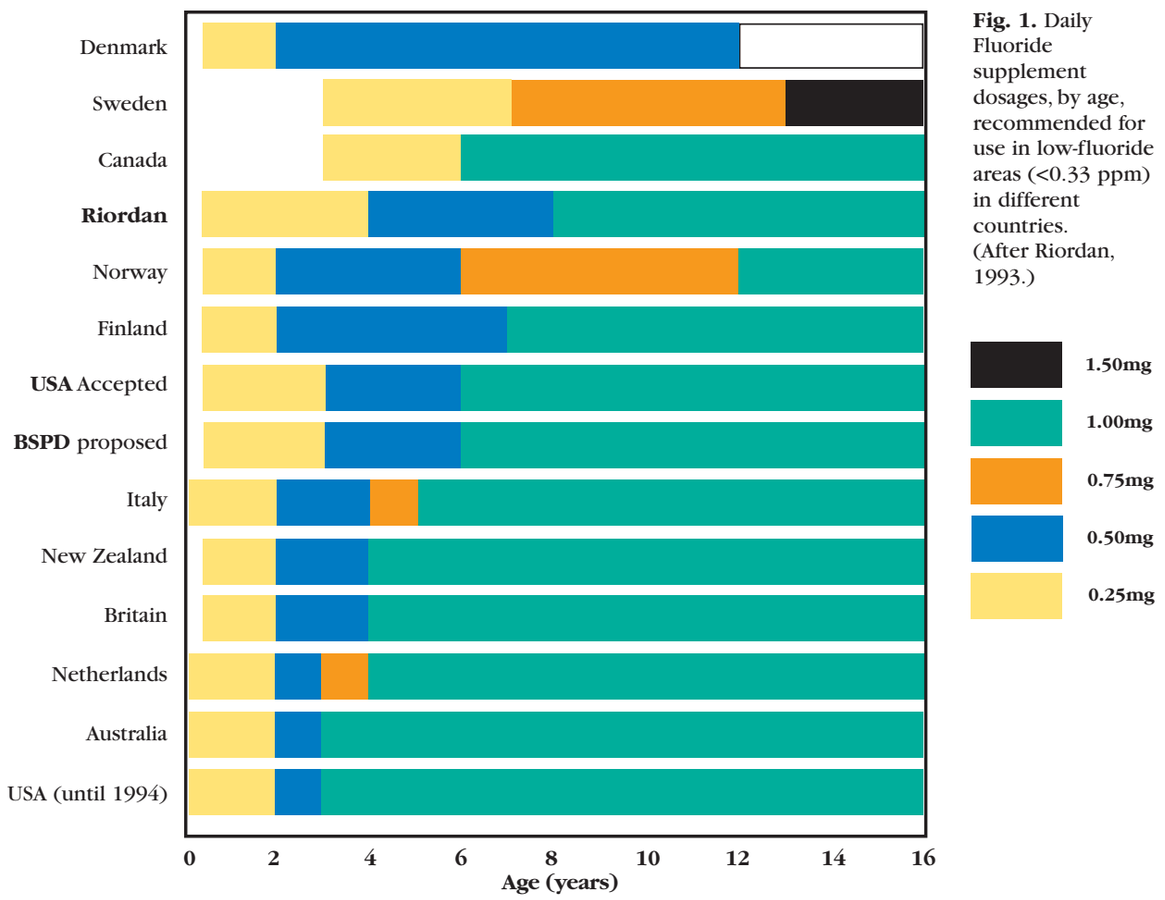


Fig. 1. Daily Fluoride supplement dosages, by age, recommended for use in low-fluoride areas (<0.33 ppm) in different countries. (After Riordan, 1993.)

It is agreed that dietary supplements are not generally suitable as a public health measure and that they should be directed towards children who require them and who live in areas with suboptimal water fluoride levels. Children who stand to benefit include those for whom caries or its treatment may pose an additional hazard, as well as children thought likely to develop caries. For many of these children the potential disadvantage of mild enamel opacities may be outweighed by the benefits of fluoride supplements. It is also agreed that, when given as tablets, supplements should be allowed to dissolve slowly in the mouth to provide topical as well as systemic effect. [4] Both to reduce the risk of opacities and to maximise their effectiveness, supplements should not be given at the same time as teeth are brushed.

There has been less consensus as to the most appropriate dosage schedule. A summary of current schedules used in different parts of the world is given in Fig. 1, which is modified from a recent review. [4] It may need to be accepted that any dosage schedule which includes the critical period of enamel formation will carry some degree of risk of mild enamel opacities, particularly if fluoride ingestion from other sources occurs at the same time. The risk of opacities varies with time; the age of the child is critical, with permanent teeth at risk up to the age of 6 years, and permanent incisors during the first 3 years of life. [12] The caries risk status of a child may also change with time, so that regular reassessment is needed. Parents must be fully involved in the decision and, where a dentist or doctor wishes to prescribe supplements, the risks and benefits need to be clearly explained to allow parents to make an informed choice.

FLUORIDE TOOTHPASTES

Toothpastes containing fluoride were widely introduced in the UK during the 1970s; they have been demonstrated to be effective in reducing caries and are believed to have played a large part in the decline in caries observed in many westernised countries. [13] Formulations have differed and there have been studies into the effect of varying fluoride concentrations. Reducing the concentration below 1 mgF/g has not always produced a statistically significant reduction in effect. [14] At present, toothpastes on the market include concentrations varying from 0.4 mgF/g of paste to 1.5 mgF/g of paste. [15] Lower fluoride formulations were found to be used by at least 34 per cent of pre-school children in Great Britain in 1992/93. [16] Choice is made difficult by the lack of clear standard labelling on toothpaste packaging. Accreditation of toothpastes is now available. For accreditation by the British Dental Association, manufacturers must submit scientific evidence of clinical efficacy and safety to an expert panel.

Evidence to link opacities to the ingestion of fluoride toothpastes by young children has not always been clear; use of a lower fluoride formulation has resulted in a lower prevalence of opacities, although the association was less marked than that with supplements. [17] The potential risk has been well documented. [15,18,19] Relatively small amounts of toothpaste contain sizeable amounts of fluoride, and it has been estimated that the threshold level for opacities may be exceeded by ingestion of toothpaste; this holds true even when the currently recommended pea-sized amount is used. [15]

It is the abuse through ingestion rather than the use of fluoride toothpastes which constitutes the main risk of opacities. However, in view of some concern regarding opacities and the fact that toothpaste is very widely used, it would seem sensible to recommend that only small amounts of paste be used, under adult supervision, in the critical phases of tooth development during the first 6 years.

Children considered to be at low risk of caries living in fluoridated areas or using fluoride supplements, should use low-fluoride formulations. Low caries-risk children include regular attenders at the dentist, who have no or well-controlled caries, and those whose parents show a high degree of motivation (including carrying out/helping with, or supervising toothbrushing and exercising good dietary control). Those with a higher risk of developing caries should use a standard paste. For this purpose, children at high risk may be taken to include children with a disability that affects their dental care and those who are medically compromised. Children with numerous new or recurrent carious lesions and with radiographic evidence of progression of lesions, irregular attenders, those having sweetened medicines and/or with poor dietary control and those receiving little assistance with toothbrushing may also be regarded as being at high risk.

Up to the age of 6 years parents must supervise the amount of toothpaste used. From age 6 upwards, anterior teeth are not at risk of opacities, so that higher fluoride pastes may be safely used and should be particularly recommended for children at high risk.

RECOMMENDATIONS

1. Water fluoridation remains a priority. Government should take action to increase pressure on privatised water companies to fluoridate water supplies when requested to do so by local health authorities.

2. Dietary fluoride supplements are not generally a public health measure. They should be recommended only for individual children who are at risk and who live in areas with less than optimal water fluoride levels.

Each case should be decided on its merits, and the risks and benefits of supplements should be fully explained to parents before prescription. A flexible approach should be adopted and a child's risk status regularly reassessed.

3. For children living in areas with water supplies containing less than 0.3 ppm fluoride and who are considered to be at high risk, the recommended dosage schedule should be:

Age	mg F per day
6 months up to 3 years	0.25
3 up to 6 years	0.50
6 years and over	1.00

In areas with water supplies containing fluoride at or above 0.3 ppm F dentists should consider a lower dosage.

4. To reduce the risk of opacities, children under the age of 6 years and considered to be at low risk of developing dental caries should use a toothpaste containing no more than 600 ppm of fluoride. Those with a higher risk of developing caries should use a standard (1000 ppm) paste. Children over the age of 6 should be encouraged to use a standard (1000 ppm) or higher (1450 ppm) fluoride level paste. Toothpastes accredited by the British Dental Association should be recommended.

5. Children under 6 years old should use an amount of toothpaste no greater than a small pea. Formal recommendations should emphasise small, rather than rely simply on pea-sized amount, which may be too much. To reduce the risk of opacities, parents must supervise the amount of toothpaste used during brushing up to the age of 6 years. Help with or close supervision of brushing up to at least 7 or 8 years is recommended to ensure effective plaque removal.

6. To allow informed choice, toothpaste packaging must include clear labelling to indicate the amount of fluoride present, expressed consistently as ppmF. Packaging should also include warnings of the risk of opacities and encouragement to parents to keep toothpastes out of reach of young children.

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DENTAL NEEDS OF CHILDREN

International Journal of Paediatric Dentistry 1997; 7: 203-207.

This document was prepared by June Nunn, Peter Crawford, Jim Page and Gerry Winter. Policy documents produced by the BSPD represent a majority view, based on a consideration of currently available evidence. They are produced to provide guidance, with the clear intention that the policy be regularly reviewed and updated to take account of changing views and developments.

BACKGROUND

In 1989 a working group of the British Paedodontic Society (now the British Society of Paediatric Dentistry) under the chairmanship of Professor John Murray produced a policy document on the dental needs of children in the United Kingdom, [1] which was published in 1990. The intervening years have seen the implementation of recommendations made in a number of Government reports and papers. In the autumn of 1990 the "new contract" [2] became a reality with radical changes to the way in which general dental services were to be provided. In the same year the Department of Health published "Development of Community Dental Services, HC(89)2", dealing with the future role of the Community Dental Service in England and Wales [3]. Thus there has since 1989 been a major change in the way in which dental care for children has been provided within both the Community and General Dental Services.

In 1994 the results of the National Child Dental Health Survey in 1993 [4], and in 1995 the 1992/93 National Diet and Nutrition Survey of pre-school children, including the results of an oral health survey [5], were published.

From the trends in dental disease identified in these recent national dental surveys it is likely that without a more aggressive approach to the prevention and treatment of oral disease, the aims set in the Oral Health Strategy documents [6-9] for the UK will not be achieved in the short term for children, nor in the long term for adults.

If the adverse trends in oral health in children and young people are to be reversed, fundamental changes in the provision of primary dental care for young people will be required. The most important of these are the setting of a realistic level of remuneration for general dental practitioners treating children in the NHS and assurance of an adequate supply of appropriately trained staff within the Community Dental Service. For the future, the recognition of Paediatric Dentistry in the Chief Dental Officer's report on Specialisation in Dentistry, and the setting up of a Task Force for this Specialty, are vital developments in ensuring high-quality comprehensive oral health care for children and adolescents is readily available and accessible to all.

CHILD DENTAL HEALTH IN THE 1990s

The pre-school child

The recent publication of the National Diet and Nutrition Survey undertaken on behalf of the Department of Health for pre-school children aged 1 ½ - 4 ½ years included an oral health survey [5]. Information was available from a sample of 1658 pre-school children from 100 districts in mainland UK. It was found that, overall, 17 per cent of children in this age group had some caries experience, but particularly worrying was the observation that 83 per cent of carious teeth were untreated.

The longest period of study of pre-school children in the UK has been carried out in Camden over nearly 30 years [10-12]. The 1986 Camden Survey had already suggested that the continuing improvement in the dental health of pre-school children had not occurred and that there had been a slight upturn in the caries prevalence. The results of the 1993/94 [13] study show once again that the burden of dental caries falls most heavily on children from the most socio-economically disadvantaged groups of the population, i.e. families with unemployed fathers and families in some ethnic minority groups. These observations have since been confirmed amongst other 5-year-old children in different parts of the UK [14]. Significant improvement in the dental health of pre-school children is unlikely to occur in the foreseeable future without fluoridation of the nation's drinking water supplies where appropriate. To prevent the ravages of caries affecting successive generations of children, further efforts are required to ensure that the most recent recommendations contained in the COMA report on Weaning and tne Weaning Diet [15] are emphasised sufficiently in local oral health promotion initiatives.

As far as treatment services are concerned, there is little indication that the introduction of a capitation system of payment for the dental care of children in the General Dental Service in 1990 has had a positive impact on the oral health of the youngest children; registrations within the GDS for the 0-2-year-olds is less than 20 per cent across the UK.

Referrals of new patients to specialist centres for paediatric dental care as well as general anaesthesia rose by as much as 207 per cent in some centres in the second year after the introduction of capitation [16].

The school age child and adolescent

The 1993 survey of child dental health [4] documented further, albeit inconsistent, change; although dental caries experience in the oldest children had declined to the extent that 63 per cent of 15-year-olds had experienced caries in 1993 compared with 93 per cent in 1983, the same could not be shown for the younger children. In 5-year-olds there was virtually no change in caries experience over the decade and the evidence from the most recently published BASCD survey of 5-year-old children has

shown a deterioration over the period between 1989/90 and 1993/94 with an 11 per cent increase in the dmft, a fall in the number of restorations and a 30 per cent increase in untreated decay [14].

The national survey of children's dental health also recorded periodontal status, features of any malocclusion present, trauma to the dentition, developmental defects of enamel and dental erosion [4]. Disappointingly, there has been little measurable improvement in periodontal status, with still about half the children experiencing gingivitis and approximately one-third of children having calculus present. Although there was a decline in the prevalence of trauma between 1983 and 1993, there has been (in the older children at least) a welcome increase in treatment provided, although still only one-third of traumatised teeth in this age group are treated. This needs to be seen against a background of a change in the way dental care was remunerated in the general dental services during the latter part of this period, when only trauma involving the pulp attracted a payment separate from the capitation fee. Considerable efforts were made for the 1993 survey to include as many features of malocclusion in the assessment in order that an index of orthodontic treatment need could be generated. Although it would appear from the data that more treatment is being provided, over 30 per cent of children approach school-leaving age with untreated malocclusions.

Disquiet has been expressed [17] that the widespread use of fluoride dentifrices at 1000 ppm in young children has the potential to produce enamel mottling. The prevalence of enamel defects has not previously been assessed in a national survey but it was encouraging to see from the results that diffuse opacities - those defects most likely to be associated with excessive fluoride ingestion - were not the type of opacity most commonly recorded. The appropriate dosages for fluoride supplements together with the relevant type of toothpaste to be used in conjunction are published elsewhere [18]. Effort is needed to ensure that children are using these beneficial products correctly.

There is concern in the dental profession about the increasing prevalence of non-carious tooth surface loss, specifically dental erosion, in young people. This has been linked anecdotally to an increase in both the variety and frequency of consumption of soft drinks, paralleling the increase in volume of sales of such products in the recent past [19]. There is also evidence that gastro-oesophageal reflux, a source of intrinsic acid, occurs in children more commonly than was previously thought [20]. The national survey of children's dental health [4] was the opportunity to record the prevalence of dental erosion in young people and, like the survey of preschool children [5] carried out at about the same time, documented significant levels of erosion in all age groups. In the former study, 34 per cent of 14-year-olds had evidence of loss of enamel and dentine from the palatal surfaces of maxillary incisor teeth. In the latter survey, half the $3^1/^2$ - $4^1/^2$ year-olds had some evidence of dental erosion on palatal surfaces of primary maxillary incisors.

It has to be borne in mind that the data from the national surveys represent mean figures which mask individual children with a high prevalence of disease. Missing too from these data are the hidden group of children and young people with significant physical, intellectual and other impairments who, on the evidence of the limited information in the literature [21], have made little if any improvement in their dental health over the period of the recent decennial national survey of children's dental health [4]. This group includes children who are at high risk of developing dental disease and who may also be placed at risk by its treatment.

SCOPE FOR CHANGE: THE GENERAL DENTAL SERVICES

The new contract in 1990, and specifically the capitation system for the care of the 0-18 age group, was designed to foster a more preventively orientated approach to the care of registered patients through continuity of care. One consequence of these changes was that the proportion of GDS funds paid for the care of children increased from 18 per cent in 1989/90 to 24 per cent in 1995/96.

In money terms this means that £174m spent in 1989/90 has grown to £313m 6 years later, an increase of 80 per cent, during a time when the retail price index has increased by 26 per cent. However, despite the evidence that more money is going towards the oral care of children, dentists (with few exceptions) feel that they are worse off under this form of contract. If capitation is to succeed, a complete change in practice philosophy is required, since, according to Guay: "In a service-based system, the treatment produced is a revenue centre and a source of profit. In a capitation-based system, treatment is a cost centre and a drain on profits" [22].

Although the introduction of capitation was supposed to encourage a move towards prevention and to reduce the emphasis on treatment, from the published data [4,5,14] it would appear to have succeeded only in the latter, to the detriment of oral health. The introduction of fees for restorations and extractions in 1996 may address this problem, but detracts from the real need, which is for preventive care to be more actively pursued.

Capitation, to whatever extent it may have been implemented, has the potential to work in areas where parents are highly motivated and dental disease experience generally low. Any modification to the existing capitation system must acknowledge that investment has to be made in the younger age groups since it is for the under-6s that the foundations of prevention must be laid. Current remuneration for this age group does not recognise this. Comparison of capitation fees with average practice overheads will dictate that annually only about 5 minutes can be spent with the 0-2 year olds and 10 minutes with the 3-5 year olds [23]. Clearly this is a derisory amount of time to devote to this important task. If the appropriate advice on diet, oral hygiene and fluorides cannot be given to these

age groups because it is uneconomic to do so, then an opportunity has been lost to recruit and maintain orally healthy children to the practice. Consideration needs to be given to the more widespread deployment of dental auxiliaries in the GDS, enabled to undertake simple oral procedures for young people. By these means a more cost-effective capitation system may be viable.

One of the problems that has always been of concern with regard to the care of children in the GDS is that of standards. Standards were originally made deliberately vague so as to maintain clinical freedom for the practitioner. This has resulted in a very wide interpretation of what is acceptable when treating children. The current definition of oral health in the GDS regulations is ambiguous, but the definition given in the Oral Health Strategy for England [6] encompasses what is presumably intended: "Oral health is a standard of health of the oral and related tissues which enables an individual to eat, speak and socialise without active disease, discomfort or embarrassment and which contributes to general well-being". With the now very clear move towards evidence-based medicine in all areas of the Health Service we need to move beyond this definition and to define clinical guidelines based on audited work. The British Society of Paediatric Dentistry would be keen to endorse this development in regard to oral care for children. For example, all the clinical research evidence over the last 20 years points to the superiority of preformed metal crowns as a restoration for primary molar teeth [24] yet very few are provided in the general dental services. Likewise, the provision of appropriate pulp therapy as an alternative to the removal of primary teeth is to be strongly endorsed.

For oral health care for the child and adolescent population of the UK to develop to the standard provided in many European countries and North America, greater emphasis needs to be given to raising the standards and content of the teaching of Paediatric Dentistry within vocational training modules (this will be especially so with the advent of General Professional Training and the move to specialisation); also, strenuous efforts have to be made to increase the number of consultants in Paediatric Dentistry. This will ensure that not only will specialist services be more equitably distributed and therefore accessible but that sufficient numbers of consultants will be available to provide training for the development of specialisation in paediatric dentistry in the future. If the current poor distribution of consultants is to be addressed, recognition of the number of women in training and thus the need for flexibility in training programmes, as well as the availability of part-time posts, is important.

THE COMMUNITY DENTAL SERVICE

When the first policy document appeared [1] the Community Dental Service (CDS) was in the throes of change. Following on the Department of Health Circular HC(89)2 the CDS [3], in many areas, has had to develop rapidly its safety-net function not least because of local unavailability of general dental services. Alongside this has been a contraction in the work-force within the Service so that, compared with 5 years ago, the number of clinical community dental officers has declined from 815 to 649. During a similar time period the number of hours devoted to the treatment of disabled adults in the CDS has risen from 66,140 to 122,462 [25]. The contraction in the workforce, particularly in areas of high disease where there was a demand for services from the normal school-child population, has denied many of the most vulnerable children a valued service. The inability of many users of the CDS to make the transition to the GDS [26] emphasises the need to go on providing an effective safety-net service particularly when screening frequency in schools is much reduced compared to the time prior to publication of HC(89)2 [3]. A role for dental auxiliaries in the screening and recall of children, particularly for the reinforcement of preventive advice and care, should be explored and tested.

RECALL INTERVALS FOR CHILDREN AND ADOLESCENTS

To an extent the debate about appropriate intervals for the recall of young people in particular has been overtaken by recent changes within the GDS. Capitation theoretically allows the clinician, having identified children at high risk from dental disease, greater freedom to see them at a frequency appropriate to their clinical need. However, if prevention is to be effective then clinicians need to be more, rather than less, vigilant. For example, radiographs, particularly for the detection of caries, should be taken as soon as the co-operation of the child allows but particularly in the pre-school age group for the high-risk child. It would be anticipated that bitewing radiographs should be taken at 2 yearly intervals unless there is evidence of caries on previous films, when the frequency may need to be 6 monthly to monitor activity. Radiographs at 6-7 years of age to detect developmental anomalies and ascertain the presence of permanent teeth would establish a useful baseline. A dental panoramic tomogram or bilateral oblique views, together with any necessary upper and lower occlusal views, are to be recommended [27].

What has emerged since the contractual changes in the GDS came into force is, according to the epidemiology being presented, some evidence of under-treatment and, by implication, an extension of recall intervals. Prevention and the early detection of oral disease are reliant on short recall intervals, particularly in the primary dentition where disease progresses more rapidly in a susceptible child. When adults recount unpleasant dental experiences in childhood, extractions and general anaesthesia are the episodes most often cited; the majority of these have been experienced before the age of 10 [28].

RECOMMENDATIONS

1. Since dental caries remains the single most prevalent oral disease in children, fluoridation of the water supply must remain the primary objective of the oral health promotion policy of many districts as

the most cost-effective means of reducing the burden of oral disease.

2. Changes to the way in which oral health care is provided for children and adolescents in the UK are largely based on the dental data collected in local and national surveys. It is vital to the monitoring of oral health in young people that these surveys continue.

3. A higher priority needs to be accorded to safeguarding the oral health of young people by a more aggressive preventive approach, thus avoiding disease with unpleasant treatment consequences. Bad experiences of dental treatment in childhood have been shown to provide a barrier to regular attendance in adulthood.

4. The continuing professional training of all practitioners in Primary Dental Care needs to be integrated and strengthened to ensure the availability of efficient and effective oral care for children and adolescents.

5. The remuneration system in the GDS should be structured in such a way that it does not compromise the oral care of children and adolescents and emphasises the importance of early prevention of oral disease.

6. The complementary role of the CDS should be developed and strengthened to ensure that children at "high risk" maintain access to quality dental care.

7. The shortfall in the numbers of consultants in Paediatric Dentistry needs to be addressed because in Centres where consultants are in post there has been a dramatic increase in demand for care since 1990. Additional numbers of consultants will be needed to ensure the recruitment and provision of high-quality teaching of future specialists in paediatric dentistry.

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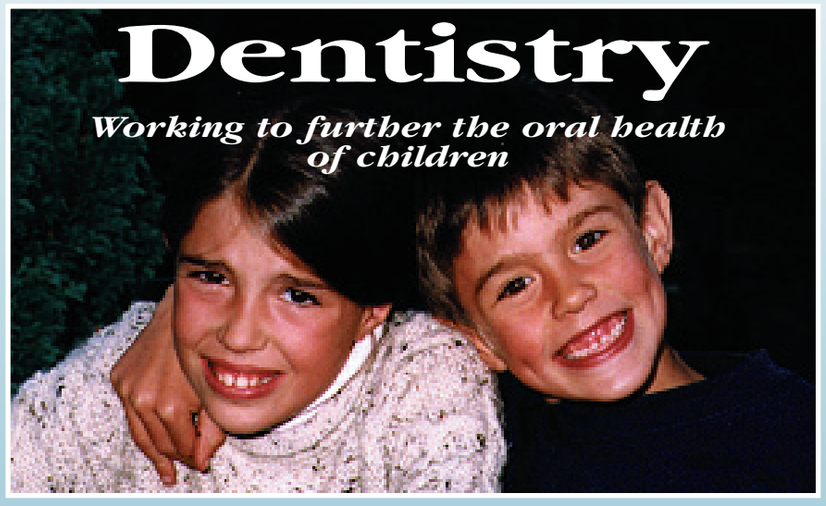

The British Society of Paediatric Dentistry (BSPD) is the national society specifically concerned with the oral health of children in the UK. It aims to improve oral health in children and encourage the highest standards of clinical care.

BSPD has over 700 members from university and hospital paediatric dental departments, the community dental service, specialist paediatric dental practices and general dental practice. Undergraduate students, dental therapists, hygienists and other dental auxiliaries are also encouraged to join at specially reduced rates.

The Society has representation on various committees and bodies involved in the development of oral health strategies, and has produced policy documents on various aspects of oral health and dental care for children.

The Society has 13 branches which meet locally on a regular basis. These meetings have an educational as well as a social function, and include speakers invited to update members about new developments in the field and its associated specialities.

If you would like further information about the Society and membership, please contact the National Secretary:

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ACKNOWLEDGEMENTS

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DPB
DENTAL PRACTICE BOARD
FOR ENGLAND AND WALES

Approved by
The Faculty of Dental Surgery of the Royal College of Surgeons of England

Consultants Group in Paediatric Dentistry, United Kingdom

British Society of Paediatric Dentistry

Acknowledgement
Policy Documents produced and approved by Council of British Society of Paediatric Dentistry

Overall Editor: Terry A Gregg