Efficacy of dental prophylaxis (rubber cup) for the prevention of caries and gingivitis: a systematic review of literature

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IN BRIEF

- For the prevention of caries in children, dental prophylaxis need not be provided either at a recall visit or before the application of topical fluorides.
- For the prevention of gingivitis in the general population, dental prophylaxis at recall appointments is not effective for the prevention or treatment of gingivitis.
- Dental prophylaxis remains of benefit for child management and for stain removal and aesthetic considerations.

Background The purpose of this systematic review was to assess the efficacy of routine dental prophylaxis applied before professionally applied topical fluoride (PATF) or at a regular recall visit in the prevention of caries or gingivitis. **Types of studies reviewed** Ovid MEDLINE and its allied versions; CINAHL; Cochrane Library; EMBASE; Health and Psychosocial Instruments; HealthSTAR; International Pharmaceutical Abstracts; and ACP Journal Club were searched for English and Human articles from 1966 to 2007 for original *in vivo* English publications assessing rubber cup dental prophylaxis. *In vitro* studies, case series, case reports or letters to editors (not containing primary data), editorials, review articles and commentaries were excluded but were read to identify any potential studies. **Results** One hundred and eighty-nine articles were searched for relevancy resulting in six original studies that met our inclusion criteria. There was a unanimous agreement in four studies that a dental prophylaxis is not warranted before a PATF for caries prevention in children. A generalisation on dental prophylaxis before PATF cannot be applied to adolescents and adults. Available evidence (two other studies) fails to demonstrate any benefit in the prevention of gingivitis from further dental prophylaxis at interval used for recall examinations. **Clinical implication** To prevent caries in children, dental prophylaxis need not be provided either at a recall visit or before PATF. Dental prophylaxis at intervals of four months or more is not justified for the prevention of gingivitis in the general population.

BACKGROUND

Dental prophylaxis typically consists of placing pumice or an abrasive paste in a rubber cup and applying the paste to the clinical crowns of the teeth using rotating rubber cup at slow speed. This aims at the complete removal of plaque, salivary pellicle, *materia alba* and extrinsic stains found on the crowns of teeth to reduce and prevent future dental caries. The clinical protocol for performing a routine dental prophylaxis before professionally applied topical fluoride (PATF) was first advanced by Knutson.¹ The rationale behind this was the belief that *materia alba*, plaque and other natural coatings on tooth surfaces

acted as a barrier, inhibiting fluoride uptake and consequently reducing the clinical efficacy of the topical fluoride application.^{2,3} Many clinicians believe that the removal of the acquired pellicle, plaque and other substances adhering to the enamel by professionally applied prophylaxis results in a greater amount of fluoride contacting the enamel surface, thus enhancing the efficacy of a PATF,^{2,4} and an expected increase in the reduction in the incidence of caries. The removal of plaque can be effectively accomplished with a toothbrush. However, the belief is that the acquired pellicle, a thin organic layer adherent to the surface enamel, can only be removed by pumice or other abrasive prophylaxis.² The role of bacterial dental plaque in the aetiology of gingivitis and periodontal disease has been well established.⁵ Part of the prevention of such conditions is based on limiting the accumulation of micro-organisms on the teeth and maintaining a flora that is consistent with periodontal health.

Three separate studies have evaluated the effect of dental prophylaxis before PATF on the amount of fluoride uptake by

enamel *in vivo* by comparing professionally cleaned and uncleaned teeth. Tinanoff *et al.*² concluded that the acquired pellicle does not inhibit or retard the deposition of fluoride in the surface enamel. Bruun *et al.*⁴ agreed. Results demonstrated that plaque-covered teeth took up more than twice the amount of fluoride than was taken up by cleaned teeth. This suggested the presence of plaque and *materia alba* on teeth might even contribute to a greater uptake of fluoride through increasing the exposure time of enamel to the fluoride contained in the plaque. Steele *et al.*⁶ conducted a similar study with the addition of assessing the effect of tooth brushing and flossing before PATF. They found that tooth brushing and flossing before PATF resulted in higher retained fluorine [sic] concentrations in surface enamel than did prophylaxis either using a fluoridated or non-fluoridated prophylaxis paste.

These studies show that the flow of fluoride ions into the enamel is not inhibited by the presence of the acquired pellicle, plaque and other natural substances on the surface of teeth. However, these

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findings on the amount of fluoride uptake by enamel cannot be directly correlated with the clinical initiation and progression of caries.

The dental profession has, in the past, accepted that periodic dental prophylaxes result in beneficial consequences for the periodontal tissues. Thus, many providers include dental prophylaxis as a gingivitis prevention measure at each recall appointment. Studies in the 1970s demonstrated the frequent use (bimonthly) of dental prophylaxis preceded by a comprehensive oral hygiene instruction (OHI) session as a measure to improve gingival health among adolescents.^{7–10} However, more recent studies do not support the efficacy of the sole provision of the dental prophylaxis procedure for the prevention of gingivitis.^{11–14} In partial support, in an earlier Cochrane review,¹⁵ insufficient evidence of either beneficial or adverse effects of routine scaling and polishing was found. This was a review of different time intervals and was for periodontal health.

An earlier evidence-based report on oral hygiene practices states that dental prophylaxis or polishing (no scaling) is not warranted for periodontal disease prevention and is solely an aesthetic procedure.¹⁶ Others have issued statements on this practice. The American Dental Hygienists Association (ADHA) has promulgated two position papers that are relevant to this discussion, the first on polishing,¹⁷ in which they recommended polishing to be performed only as needed and not be considered a routine procedure, and a second on dental prophylaxis,¹⁸ in which they stated that 'there is no evidence that supragingival scaling and coronal polishing have any therapeutic value'. The American Academy of Pediatric Dentistry (AAPD) has also addressed both prophylaxis and oral hygiene in Vision, Mission, Strategic Directions and Policies and Guidelines in their reference manual.¹⁹ The recommendations for 'oral prophylaxis and topical fluoride treatment' (noted as 'especially for children at risk for caries and periodontal disease') is to provide at 12–24 months throughout their childhood to age 18 years. The 'Clinical Guideline for The Role of Prophylaxis in Pediatric Dentistry' recommends that:¹⁹

Table 1 Yield of the literature search

#	Search history	Results
1	(Dental prophylaxis or tooth cleaning) in title or abstract	1,463
2	(Caries or Gingivitis or Fluoride or acidulated phosphate fluoride or APF) in title or abstract	100,890
3	1 and 2	579
4	Remove duplicates from 3	225
5	Limit 4 to English publications	207
6	Limit 5 to human studies	189
7	Limit 6 to year = "1966 - 2007"	189
8	Updating the search strategy #1 to #6 from 2007 to February 2009	23
9	Total included for Title/Abstract screening (#7 and #8)	212
10	Included articles after Title/Abstract screening	62
11	Included articles for critical appraisal at the full copy stage	18
12	Secondary search from references	4
13	Scored for critical appraisal (#11 and #12 above)	22
14	Excluding those with experimental design of prophylaxis application (for example, once a week)	10
15	Critically appraised and scored	12
16	Scored but not meeting routine prophylaxis criteria, see Table 5	5

1. The dental prophylaxis should be used as part of a comprehensive prevention programme designed to improve children's ability to maintain their oral health. The use of dental prophylaxis should be considered as an educational tool to allay patient fears regarding the manipulation of oral tissues
2. A patient-appropriate dental prophylaxis should be performed when indicated, in conjunction with OHI, periodic oral examination visits and other indicated preventive care.

This evidence-based report seeks to assess the efficacy of routine dental prophylaxis applied before professionally applied topical fluoride (PATF) or at a regular recall visit for the prevention of caries or gingivitis for all patients. More specifically, the report attempts to answer the following focused questions: Does dental prophylaxis provided at recall appointments reduce caries increments, on its own or in combination with PATF, or improve gingival health?

Caries increment is the amount of new caries since the previous measurement in the sample of the study and is a measure of success or failure of the intervention. In order to find the most relevant answers

to the above-mentioned questions, we assumed that any benefit in improved health outcomes must be both clinically (ie the smallest difference that clinicians and patients feel improves oral health or wellness) and statistically significant ($p < 0.05$); and if there is no benefit at the threshold of both clinical and statistical health improvement, then the procedure should not be used for that purpose. To correspond to conventional recall frequencies, we selected only the studies with prophylaxis given at a recall appointment at intervals of four months or more as our working definition of dental prophylaxis provided at recall appointments.

METHOD

Literature search

Literature searches of the 1966 to February 2009 database using Ovid MEDLINE and its allied versions; Cumulative Index to Nursing and Allied Health Literature; Evidence Based Medicine of Cochrane Central Register of Controlled Trials; Cochrane Database of Systematic Reviews; Database of Abstracts of Reviews of Effects; EMBASE; Health and Psychosocial Instruments; HealthSTAR; International Pharmaceutical Abstracts; and ACP Journal

Table 2 Quality of published evidence

Recommendation grades for specific clinical preventive actions	
A	The CTF concludes that there is good evidence to recommend the clinical preventive action.
B	The CTF concludes that there is fair evidence to recommend the clinical preventive action.
C	The CTF concludes that the existing evidence is conflicting and does not allow making a recommendation for or against use of the clinical preventive action, however other factors may influence decision-making.
D	The CTF concludes that there is fair evidence to recommend against the clinical preventive action.
E	The CTF concludes that there is good evidence to recommend against the clinical preventive action.
I	The CTF concludes that there is insufficient evidence (in quantity and/or quality) to make a recommendation, however other factors may influence decision-making.
The CTF recognises that in many cases patient-specific factors need to be considered and discussed, such as the value the patient places on the clinical preventive action, its possible positive and negative outcomes, and the context and/or personal circumstances of the patient (medical and other). In certain circumstances where the evidence is complex, conflicting or insufficient, a more detailed discussion may be required.	
Levels of evidence – research design rating	
I	Evidence from randomised controlled trial(s)
II-1	Evidence from controlled trial(s) without randomisation
II-2	Evidence from cohort or case-control analytic studies, preferably from more than one centre or research group
II-3	Evidence from comparisons between times or places with or without the intervention; dramatic results in uncontrolled experiments could be included here
III	Opinions of respected authorities, based on clinical experience; descriptive studies or reports of expert committees
Source: Canadian Task Force on Preventive Health Care ²¹	

Club were conducted. The subject heading 'dental prophylaxis' was combined with several key words: caries, fluoride, acidulated phosphate fluoride (APF), gingivitis or periodontal disease, harm, benefit, risk in title and/or abstract. The searches were limited to English language articles and human trials.

Search strategy

The articles were limited to original human studies assessing rubber cup dental prophylaxis. All other studies including *in vitro* studies, reviews, case series, etc were excluded but read to identify potential studies. Further articles were identified by reviewing the references and bibliographies of the retrieved articles. All articles at each stage were independently reviewed by both authors and discrepancies were resolved by consensus. The yield is summarised in Table 1. Twenty-two articles were retrieved, of which ten were not relevant to the focused question of this review and therefore did not meet our inclusion criteria, mainly because these articles had experimental designs of prophylaxis application (ie prophylaxis) at a more frequent interval, for example once a week. The remaining 12 were scored using the *Checklist to assess evidence of efficacy of*

therapy or prevention.²⁰ This checklist consists of questions addressing ethics, study design, methodology and appropriateness of the results to the population of interest. The cut-off point for inclusion was set at 11 (out of a potential score of 16 for the checklist), resulting in a total of six articles. For each included article, the level of evidence was rated according to the classification developed by the Canadian Task Force on the Periodic Health Examination²¹ (Table 2).

RESULTS

With the use of the inclusion criteria, a total of four articles relating to dental prophylaxis and caries prevention and a total of two articles relating to dental prophylaxis and gingivitis prevention were selected for inclusion in the evidence table. The level of evidence and the recommendations for each article are listed in Tables 3 and 4. A further five articles (Table 5) are addressed since they are widely referred to, but in reality do not address routine prophylaxis as defined in this review.

Dental prophylaxis and caries prevention

We searched for studies that assessed the efficacy of bi-annual applications of

fluoride on defs/DMFS/DMFT increments over a period of time. As seen in Table 3, Ripa *et al.*³ (randomised clinical trial, Level I) and Houpt *et al.*²² (prospective, level II-1) carried out similar studies. In both studies, children (1,453 children aged 10-14 yrs in the former and 1,519 children aged 9-13 yrs in the latter) received twice yearly APF topical fluoride gel-tray treatment. Before the fluoride treatment, children were divided into three groups: Group 1 received prophylaxis with non-fluoridated paste, Group 2 brushed and flossed their own teeth under supervision, and Group 3 had no specific tooth cleaning procedure before the topical fluoride treatment. These children were followed up for three years in the former and for two years in the latter study. The results of both studies revealed no statistically significant differences in DMFS/DMFT increments between a PATF with or without a prior prophylaxis (grade of recommendation D/E; see Table 2)

Bijella *et al.*²³ undertook a longitudinal clinical study (level II-1) to evaluate the effect of dental prophylaxis before the topical application of acidulated phosphate fluoride solution applied twice a year in 160 schoolchildren aged 7-10 yrs. These children were divided into three groups: Group I: control group, had no treatment;

Table 3 Summary of level of evidence and recommendations for dental prophylaxis in caries prevention

Author, Date	Population	Intervention/Test	Control	Outcome	Critical appraisal comments	Level of evidence recommendation
Ripa <i>et al.</i> , 1984 ³	1,453 children aged 10–14 yrs 949 in sample at year 3.	Efficacy of prior tooth cleaning on bi-annual application of PATF over a three-year period, biannual PATF. Group II: brushed and flossed. Group III: no prior cleaning.	Positive control Group I: Biannual PATF and prophy with non-fluoridated paste	DMFT increments for three years by Group I: 2.02 ± 2.35 ; II: 1.98 ± 2.07 ; III: 2.01 ± 2.14 t test: NS (non significant) Neither toothbrushing nor dental prophylaxis before PATF enhanced the clinical efficacy of PATF.	Three year results Large loss to follow-up in year three. No control for outside care stated.	I E: Good evidence to recommend the exclusion of dental prophylaxis
Houpt <i>et al.</i> , 1983 ²²	1,519 children aged 9–13, Newark, USA.	Effect of various tooth-cleaning techniques on the efficacy of semi-annual PATF over two years (four times). Group I: prophy before PATF. Group II: cleaned own teeth prior to PATF. Group III: no prior cleaning.	542 additional children examined and received only oral hygiene instructions but no PATF as parental permission was not obtained.	Two year DMFS increments by groups I: 2.05 ± 3.4 II: 2.48 ± 4.2 III: 2.14 ± 3.4 Control: 2.50 ± 3.9 No significant differences in the groups	Two year study No control for outside care stated	II-1 D: Fair evidence to recommend the exclusion of the dental prophylaxis
Bijella <i>et al.</i> , 1985 ²³	160 children, Brazil	Effect of toothbrushing and dental prophylaxis before a PATF. Group II: twice yearly PATF, prophy with non-fluoridated paste. Group III: twice yearly PATF, prior tooth brushing with non-fluoridated paste.	Group I control, no treatment	DMFT/DMFS increments over 18 months by group I: 3.9/9.2; II: 1.4/3.3; III: 1.4/2.4 Statistical difference between the control group I and both groups II and III is stated in article but no p values were given. Differences between groups II and III were not significant. Treatment provided 64–72% caries reduction. Dental prophylaxis before PATF does not enhance the caries preventive effect of a PATF	18 month study No control for outside care stated No calculation of power.	II-1 D: Fair evidence to recommend the exclusion of the dental prophylaxis
Johnston <i>et al.</i> , 1995 ²⁴	High risk children Age 6–7: n = 176 Age 10–11: n = 153 Ontario	Biannual (twice yearly) versus annual with or without prophy to children Age 6–7 (176) Group I: (45) annual APF + no prophy Group II: (45) annual APF + prophy Group III: (39) biannual APF + no prophy Age 10–11 (153) Group I: (33) annual APF + no prophy Group II: (45) annual APF + prophy Group III: (30) biannual APF + no prophy	Routine practice. Age 6–7 Group IV (47) biannual APF + prophy Age 10–11 Group IV (45) biannual APF + prophy	DMFS increments over three years by group Age 6–7 (176) Group I: 3.82; Group II: 5.04; Group III: 3.53; Group IV: 3.93 Covariate baseline defs and DMFS were significant for three year defs + DMFS increment; $p = 0.01$. Main effect (Prophy) $p = 0.23$ Age 10–11 (153) Group I: 2.57; Group II: 2.66; Group III: 2.80; Group IV: 2.26 NS for interaction and main effects	Three years No control for APF or treatment at family dentist	1 D Fair evidence to recommend the exclusion of the dental prophylaxis.

Group 2: twice yearly topical application of APF solution with prior professional prophylaxis with rubber cup and non-fluoride paste; and Group 3: twice yearly topical application of acidulated phosphate fluoride solution with prior toothbrushing with a non-fluoridated prophy paste. They followed the children for 18 months and concluded that the addition of a prior prophylaxis did not enhance the efficacy of the bi-annual application of fluoride. Results indicated that toothbrushing before the PATF may be slightly more effective than a prior prophylaxis in decreasing facio-lingual and proximal caries (grade of recommendation: D).²³

Johnston and Lewis²⁴ performed a randomised, three-year, community-based clinical trial of professionally applied APF gel involving the use and non-use

of a prior dental prophylaxis and annual and biannual APF applications for high-risk children in age groups 6–7 (n = 176) and 10–11 (n = 153) years initially. Their findings were consistent with all of the above studies; neither the provision of prior prophylaxis (as compared with non-use of a prior dental prophylaxis) nor bi-annual PATF resulted in statistically significant three-year reduction in mean caries increments (grade of recommendation: D).

Dental prophylaxis and gingivitis

The literature search revealed a limited number of studies evaluating the effects of dental prophylaxis on gingivitis prevention. Two articles addressed the issue of the benefit from routine prophylaxis provided at the recall appointment.

Persson *et al.*¹³ performed a randomised community-based trial (level I) to examine the efficacy of bi-annual dental prophylaxis for the prevention of gingivitis as measured by bleeding on probing, the gingival component of the Community Periodontal Index of Treatment Need (CPITN). The subjects were randomly assigned to either a control group (usual procedures) or four interventions with incrementally more complex preventive strategies: two-hour cognitive behavioural training (group 2), behavioural training plus weekly chlorhexidine rinse (group 3), behavioural training plus weekly chlorhexidine rinse plus semi-annual fluoride varnish (group 4), behavioural training plus weekly chlorhexidine rinse plus semi-annual fluoride varnish plus semi-annual prophylaxis (group 5). 'The control

Table 4 Summary of level of evidence and recommendations for dental prophylaxis in gingivitis prevention

Author, Date	Population	Intervention/Test	Control	Outcome	Critical appraisal comments	Level of evidence recommendation
Persson <i>et al.</i> , 1998 ¹³	60 to 90 years old n = 297 USA	Four intervention groups, with incrementally more complex prevention strategies Group 2: behavioural training Group 3: added weekly chlorhexidine rinse Group 4: added semiannual fluoride varnish Group 5: added semi-annual prophyl.	Control Group 1: received own choice of dental care, primarily emergency.	Percentage decrease in gingival bleeding baseline to year three: Y1 Y2 Y3 1: 20 22 23 5: 20 19 23 Similar for groups 2, 3 and 4. No significant differences across groups or time	Three years No difference in the reduction of gingivitis between subjects who received and did not receive dental prophylaxis No control over the care outside the study No power calculation.	1 E: Good evidence to recommend the exclusion of a dental prophylaxis
Suomi <i>et al.</i> , 1973 ¹⁴	423 subjects 17 to 22 year old US coast guard cadets, Connecticut	Different frequencies of prophylaxis Group I: initial prophyl, 12 and 24 months Group III: initially then at 4, 8, 12, 16, 20, 24, 28 and 32 months All received PATF initially and at 12 and 24 months.	Group II: Initial prophyl then at 6, 12, 18, 24 and 30 months.	Gingival inflammation Prophyl annually Base Three year 1 0.13 0.37 2 0.14 0.35 3 0.12 0.32 All 0.13 0.35 No clinically meaningful difference after three years	Three years clinical trial, blinded examiner, no random allocation stated	II-1 E Good evidence to recommend the exclusion of a dental prophylaxis

group received dental care as they preferred, primarily emergency care.' During their three-year investigation, no significant differences were found between the test group receiving a dental prophylaxis and the control group receiving no treatment (grade of recommendation: E). This study included a broad population mix, with subjects between the ages of 60 and 90 years old (mean age 72.8), allowing a recommendation to be made for the adult population.

Suomi *et al.*¹⁴ performed a longitudinal study (level II-1) on the gingival and periodontal health of cadets aged 17 to 22 over a three-year period on different frequencies of prophylaxes, ranging from once every year to three times per year. Initially these young men had better dental and general health than the general population for their age, with baseline gingival inflammation scores of 0.13 (n = 423). After three years, gingival inflammation scores in all three groups were 0.37, 0.35 and 0.32 respectively. They found neither statistical nor clinical differences among the three groups in relation to gingival inflammation, sulcus depth or attachment loss (grade of recommendation: E). These investigations further justify the recommendation for the exclusion of dental prophylaxis for the prevention of gingivitis. These studies provide the evidence that there is no therapeutic effect of dental prophylaxis for the prevention of gingivitis.

DISCUSSION

Caries prevention

All studies that investigated the efficacy of prior prophylaxis (polishing) when performing PATF have been carried out with children. Thus, the recommendation made can only be applied to children and a generalisation cannot be applied to adolescents and adults. Only one study considered other factors that may influence DMFS/DMFT. Additional research to evaluate the efficacy of dental prophylaxis before PATF should be conducted on a larger scale with respect to sample size and age range, with all factors that might influence the clinical outcomes considered.

In 2002, Houpt²⁵ also addressed the challenges of implementing change even when one recognises the necessity for change. He cites two examples, stating that he changed his prophylaxis protocol in the 1980s once clinical research demonstrated that it was not necessary to do a prophylaxis before topical fluoride application, and the changing protocols for topical fluoride application. He comments on the slow adoption of change in regard to the provision of fluoride in fluoridated areas. This editorial generated a flurry of letters on the need for prophylaxis, for the AAPD guidelines to more clearly define when not to use a procedure, for guidelines based on current disease patterns, for evidence to address cost-effective use of professionally applied

therapies, and changes to (lengthening) the recall interval for low risk patients.^{26,27}

In agreement with this, in a 1997 survey by Main *et al.*,²⁸ only 16% of the 1,276 dentists interviewed in Ontario, Canada were aware that it is not necessary to provide a prophylaxis before topical fluoride application to achieve maximum caries protection. It was estimated that \$100 million (1997 Canadian dollars) is spent annually on combined prophylaxis and PATF in children. The Canadian Universal Code system uses a system of units of 15 minutes as a basis for setting fees. Thus, if a procedure takes 15 minutes it would be one unit of time. Based on the 2007 fees we can allocate time to PATF and prophyl. The amount of time (per procedure per person) allocated to polishing procedures, code 11101, or \$33.46 in the 2005 Ontario Dental Association fee guide, was 15 minutes, while the time allocation for a PATF, code 12101, was the equivalent of just over 10 minutes at \$23.66. Total fee for providing both services, ie codes 11101 and 12101 was \$57.12 Canadian.²⁹ If the prophylaxis procedure were to be eliminated, up to 15 minutes of professional provider time and \$33.46 could be saved. Thus, the elimination of the routine use of dental prophylaxis before a professional topical fluoride application could result in considerable savings of oral health resources in both private and public practice locations. This would permit that time to be available

Table 5 Studies not meeting routine prophylaxis criteria

Article	Population description	Intervention Test	Intervention Control	Outcome	Critical appraisal comments	Level of evidence recommendation
Hugoson <i>et al.</i> , 2007 ²³	400 subjects (211 males and 189 females), 20–27 years, from a Public Dental Service clinic and from a private dental practice, Jönköping, Sweden. At baseline: groups 1 and 4 had statistically significant lower number of sites with gingivitis and groups 2 ₁ and 2 ₂ statistically significant more sites with gingivitis than the other groups ($p = 0.05$).	Group 2: individual remedial visits every second month (six times/year). At the first visit, information on caries and gingivitis/periodontitis was presented and oral hygiene instruction was given based on plaque disclosure. This group was randomly subdivided into two halves: 2 ₁ ; $n = 50$ received no further professional tooth cleaning, after first 2 month visit. The other half ($n = 50$) was randomly divided into two sub-groups to undergo professional tooth cleaning at each visit crosswise in two quadrants: for 2 ₁ ($n = 25$), teeth in the right maxilla and the left mandible and for 2 ₂ ($n = 25$), teeth in the left maxilla and the right mandible were professionally cleaned at each visit. Group 3 ($n = 100$) – individual educational: three visits at two-week intervals the first year and OH assessment at baseline and every follow-up year Group 4 ($n = 100$) – group education: the same educational material as in Group 3 was provided to 10 groups (10 individuals in each group)	Group 1 ($n = 100$) – the control group: no remedial visits, (ie no organised prophylactic measures for caries and gingivitis/periodontitis) but had to answer a questionnaire about knowledge of dental diseases and oral hygiene behaviour. The subjects were recalled at 12-month intervals for follow-up examinations, identical to the baseline examination, over the next three years	One-year follow-up same measures as at the baseline examination. The remedial measures undertaken during the first year were repeated for the next two years with yearly follow-ups, the last one being the three-year follow-up Plaque indices (PLI) and gingival indices (GI) over three year period: All programmes resulted in a decrease in PLI and GI. Three year results: In all groups the number of sites with gingivitis decreased ($p < 0.05$). Group 1 had statistically significantly more sites with gingivitis ($p < 0.05$) than the other groups. The difference between the test groups was statistically nonsignificant The greatest decrease was found in the group that was followed-up every two months. Professional tooth cleaning was nonsignificant for the clinical result.	1- Loss to follow up = 13% after three years. 2- No control over the care outside the study 3- No similarity in baseline plaque score	1 E: Good evidence to recommend the exclusion of dental prophylaxis The statistical analysis showed that the best predictor of good gingival status at the three-year follow-up was good gingival health at baseline.
Lindhe & Axelsson, 1973 ⁷	216 children Group 1: age 7–8 Group 2: age 10–11 Group 3: age 13–14 Sweden	Information re aetiology, combination of two- or three-weekly dental prophylaxis with comprehensive oral hygiene instructions (OHI) and PATF	Brushed own teeth with 0.2 fluoride solution once per month	Percentage gingival index score = 0 (estimates from Fig. 3) YR 0 25 24 1 75 18 2 76 40 3 78 42 4 80 44	Four years Not able to demonstrate elimination of gingivitis North American patients would not attend or pay to attend every two weeks for cleaning	1 D: Fair evidence to exclude for prevention of gingivitis
Axelsson & Lindhe, 1981 ¹⁰	Adults $N = 555$ Three age groups: Group 1: <35 Group 2: 36–50 Group 3: >50 years	375 in intervention. Combination of two- or three-weekly dental prophylaxis with comprehensive oral hygiene instructions (OHI)	180 in control group. No dental health programme during the six years, other than annual recall	Percentage gingivitis score (estimates from Fig. 2) YR 0 21 18 3 10 20 6 4 24 For age <35 years (group 1) Not able to demonstrate elimination of gingivitis	Six years Significance not stated Values estimated Clinical implications North American patients would not attend or pay to attend every two weeks for cleaning	1 D: Fair evidence to exclude for prevention of gingivitis
Badersten <i>et al.</i> , 1975 ⁸	255 children 10–12 years, Jönköping, Sweden	Intervention group (113) received basic caries prevention programme and monthly dental prophylaxis and comprehensive OHI sessions, following red dye disclosing	Control (113) received basic caries prevention programme (classroom toothbrushing with 0.2% fluoride every 6 weeks) only	New carious tooth surfaces during year Exp Con 0 1.8 2.0 M+D 0.6 1.3 B 0.3 0.3 L 0.7 0.9 NS NS NS Significant reduction in the frequency of gingivitis	1 year Clinical implications North American patients would not attend or pay to attend every two weeks for cleaning	1 D: Fair evidence to exclude for prevention of gingivitis
Poulsen <i>et al.</i> , 1976 ⁹	78 high risk children aged 7 years Stratified by smooth surface lesions on permanent teeth Denmark	37 children at 12 months. Given complete restorative care before baseline and at six months. Received bi-weekly dental prophylaxis and OHI for 12 months and bi-weekly fluoride rinse	33 children at 12 months. Complete restorative care before baseline and at six months. Received no prophylaxis. Received bi-weekly fluoride rinse	Gingival index scores Base Exper Con 1 yr 1.22 1.52 1.05 0.52 Base sig: $p < 0.05$ 1 yr sig: $p < 0.01$	1 year Clinical implications North American patients would not attend or pay to attend every two weeks for cleaning	1 D: Fair evidence to exclude for prevention of gingivitis

for needed services in other people; as an example, more topical fluoride procedures could be performed, permitting more children to access and benefit from PATF for caries prevention.

Nainar³⁰ confirms the economic savings as follows: 'evidence-based caries prevention will likely result in a significant decline in preventive services revenues and create additional capacity in paediatric practices'. He suggests that the time saved by eliminating routine prophylaxis would permit paedodontists to provide services to more of the population: 'This economic impact will likely be absorbed by the current undersupply of pediatric dentists and by the reformulation of practice revenue streams'.

Of interest are articles investigating evidence-based dental prophylaxis education in post-doctoral paediatric dentistry training programmes.³¹ Their findings that 74% of the training programmes (in 2001) routinely recommended dental prophylaxis for all recall patients, and that only 51% of the training programmes had modified their teaching to substitute toothbrush prophylaxis, showed that only half of the post-doctoral programmes in the US taught evidence-based practice of dental prophylaxis for recall patients. They also surveyed AAPD members in active private practice in the six New England States in 2001 to assess their provision of dental prophylaxis.³² They found that 93% routinely recommended dental prophylaxis for their recall patients (99% for plaque, stain, and/or calculus removal, 75% for caries prevention, 82% before topical fluoride application, 58% before sealant application, and 68% for behavioural modification).

Gingival health

Studies carried out in the 1970s and early 1980s evaluated the effects of controlled oral hygiene and dental prophylaxis performed at more frequent intervals, for example once a week, using two periodontal indices, the Plaque Index and the Gingival Index. These studies were carried out using both child and adult subjects (see Table 5).^{7-10,33} For example, while four of these studies⁷⁻¹⁰ found that frequent dental prophylaxis and comprehensive OHI resulted in a reduction of gingivitis, none was able to demonstrate elimination of gingivitis, which was their stated

expectation. In fact gingivitis can develop when teeth are professionally cleaned at intervals greater than 48 hours.³⁴ Moreover, the cost-effectiveness was not substantial enough to justify recommending the procedure for clinical use with all children.⁸

It should be noted that these studies applied both dental prophylaxis and comprehensive OHI together, making it difficult to determine which was responsible for any reduction in gingivitis. For an appropriate decision, it is essential to determine the effect of the dental prophylaxis procedure alone, without OHI. Studies that followed the methodology consistent with prophylaxis alone^{11,12} concluded that there was no significant difference between the experimental population with prophylaxis and control population without prophylaxis with respect to the gingival health. This suggests that the reduced severity of gingivitis, seen in the earlier studies, was attributable to factors other than the dental prophylaxis. Therefore, in the majority of the adult population with gingivitis but without evidence of periodontitis, frequent dental prophylaxes are not warranted.

It should be noted that there are limited studies available on the efficacy of prophylaxis to improve gingival health carried out with adults and there is none carried out with children. Future studies should be conducted to investigate more clinically relevant intervals, ie limited to bi-annual or annual intervals and investigating the efficacy of dental prophylaxis treatment alone.

CONCLUSION AND EVIDENCE-BASED RECOMMENDATIONS

This evidence-based report seeks to assess the efficacy of routine dental prophylaxis applied before PATF or at a regular recall visit at intervals of four months or more, for the prevention of caries or gingivitis for all patients. The results of a thorough literature search and analysis of the above articles showed that prophylaxis before PATF does not improve caries prevention in children. This finding cannot be generalised to adolescents and adults due to a lack of such studies in these populations. Furthermore, dental prophylaxis provided at four monthly or six monthly intervals has been shown to have no therapeutic benefit in the prevention of gingivitis in adults. This review highlights the need

for additional research on the therapeutic benefits of prophylaxis.

It is therefore recommended that:

- **For the prevention of caries in children:** dental prophylaxis need not be provided either at a recall visit or before the application of topical fluorides
- **For the prevention of gingivitis in the general population:** dental prophylaxis (rubber cup) at recall appointments (of intervals of four or six months) is not effective for the prevention or treatment of gingivitis.

It should be noted that there was a limited number of studies identified in the literature that answered the review questions (four for caries prevention and two for gingivitis prevention/treatment). Therefore, more studies should be conducted on a larger scale with respect to sample size and age range, with all factors that might influence the clinical outcomes considered. Moreover, each patient is unique. Therefore, dentists should appraise the applicability of these recommendations on the individual's basis based on their professional judgement. While the evidence does not support the application of dental prophylaxis for prevention of dental caries or gingivitis, it remains of benefit for child management in particular, and for stain removal and aesthetic considerations.

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