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An audit of the caries management at the Caries Management Clinic at the Westmead Centre for Oral Health

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A thesis submitted in partial fulfilment
of the requirements for the degree of

MASTER OF DENTAL SCIENCE
Community Oral Health and Epidemiology



Faculty of Dentistry
The University of Sydney
Australia

2006

DEDICATION

This thesis is dedicated to my whole family, specially to my dear parents Rejane and Ari, and my dear uncle Euclides, and to my lovely partner, Carlos, for encouraging me and for giving me all their support through this process; and to all patients seen during the project, who made this a wonderful experience.

ACKNOWLEDGEMENTS

I acknowledge the following people for their contribution and help towards the research and preparation of the thesis:

- My supervisor, Associate Professor Wendell Evans, Head of Discipline, Community Oral Health and Epidemiology, University of Sydney, for his constant encouragement, guidance, patience and support in completing the thesis.
- Dr Peter Dennison, Director, Bachelor of Oral Health, University of Sydney, for his assistance during the project.
- Ms Ramona Grimm, Administrative Officer, Community Oral Health and Epidemiology, for all assistance during the project.
- All the staff working in the Westmead Centre for Oral Health that helped in any way through the process, specially to Dr Heather Cameron, Head of Department, Dental Clinical School; Dr Josephine Kenny, Director of Clinical Services, Oral Health Stream, Sydney West Area Health Service, Dental Administration; Mrs. Amanda Mcharg, Administrative Coordinator, the General Practice Department; Dr Ilana Fisher, Dental Officer, Sydney West Area Health Service, for their effort and assistance during the process; to all dental assistants, specially to Ms Maria Ciorogaru and Mrs. Lorraine Brown for their expertise in the clinic and friendship, and to Ms Marie-France Sanders and Mrs. Leah George, reception desk, the General Practice Department, for their patience and strength in dealing with patients.
- All staff working in the X-ray Department, especially to Mr Bruce Waters.
- Dr Leda Mugayar, Head of the Special Care Unit, Sydney West Area Health Service, for her encouragement and friendship through the process.
- Mr. Stephen Haynes, GC Asia, for providing essential material during the project.

SUMMARY

Introduction

Since the 1970's, caries preventive programs have been able to reduce caries incidence to close to zero, and almost completely eliminate periodontal disease. Such programs included: frequent professional topical fluoride applications, strict monitoring of disease activity, conscientious individual oral hygiene coaching, and oral health education by highly motivated personnel. These studies have shown that dental caries can be prevented, arrested, and that this outcome can be maintained depending on patient commitment during the follow-up period.

The purpose of this study and audit was to implement the Caries Management System (CMS) within the newly established Caries Management Clinic (CMC), and to carry out an audit of associated clinical outcomes, such as, caries reduction, oral hygiene improvement, changes in patient motivation, and dietary change.

Material and methods

A Caries Management Clinic (CMC) has been established at the General Practice Department, for patients at high risk of caries, to implement a set of protocols based on the Caries Management System (CMS), which is based on the Caries Management Policy. The Caries Management Policy is centred on (1) the patient at risk, (2) the status of the carious lesion, (3) clinical management, and (4) monitoring. The purpose of this policy is (1) to prevent the occurrence of decay on (a) existing sound surfaces and (b) along the susceptible filling margins, (2) to maintain the status of arrested lesions, and (3) to remineralize existing cavitated and non-cavitated lesions, where such remineralization, depending on lesion size, may be complete or partial. A total of 20 patients were followed-up from April until December 2005.

Main findings of the study and audit

The main findings of the study and audit after six months were:

Smooth surface lesions

- 99% of non-proximal surfaces at baseline remained sound.
- 70% of non-cavitated carious lesions observed at baseline had remineralized.
- Nine new lesions were observed.

Cavitated lesions

- 24 soft-based cavities became hard and black after treatment with fluoride varnish.

Bitewing radiolucency

- Three new lesions were observed.
- 95% of proximal sound surfaces at baseline, as diagnosed from bitewings, remained sound.
- About half of surfaces given bitewing scores of grade 1 or 2 had regressed.
- Two surfaces scored grade 1 deteriorated.
- Most of the surfaces scored grade 4 initially were associated with lesions that were later restored with GIC.

Recurrent caries

- None of the GIC restorations, followed for six months, presented with recurrent caries.

Gingival status

- A significant 42% increase in gingival sites scored as GI=0.
- A significant 21% decrease in gingival sites scored as GI=2 compared to baseline.
- Patients who were ready to change their oral health behaviour were nearly two and a half times more likely to improve their gingival status and maintain it.

Diet changes

- Patients were unable to change their diets after three months.

Discussion and recommendation

The present study and audit demonstrated that a non-invasive caries management protocol, which combined intensive coaching in oral hygiene maintenance, special home care, intensive monitoring, and frequent professional applications of topical fluoride, was able to reduce caries incidence and progression in a group of high risk patients during this short-term review.

Patients who are ready to change their oral health behaviour are more likely to improve their gingival status and maintain it. On the other hand, some patients who were not ready to change their oral health behaviour can become motivated, if they are encouraged to pursue this goal. In this sample of high risk patients, the improvement in oral hygiene is a measure of patients taking responsibility for their home care.

In conclusion, the results of this study and audit revealed that the implementation of the non-invasive approach to caries management in a clinic for high risk patients was effective, at least within the scope of this short-term review.

It is recommended that the Caries Management Clinic should continue to pursue caries management along the lines of the CMS and that the situation should be monitored and formally reviewed again, perhaps, in two years time.

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LIST OF ABBREVIATIONS

SWAHS	Sydney West Area Health Service
WCOH	Westmead Centre for Oral Health
CMC	Caries Management Clinic
CMS	Caries Management System
GI	Gingival Index (Silness & Loe)
F	Fluoride
NaF	Sodium fluoride
MFP	Mono-fluor-phosphate
GIC	glass-ionomer cement
ppm	parts per million (1 ppm F = 1 mg/L F)
RR	Risk ratio
p	p value
χ^2	Chi squared
SD	Standard deviation

PART 1

REVIEW OF LITERATURE

Summary of preventive programs for adults

The following summaries of preventive programs refer to studies that included adults aged twenty-one years and older.

Axelsson P, Lindhe J (1978). Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. *Journal of Clinical Periodontology* 5: 133-151.

Axelsson P, Lindhe J (1981). Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. Results after 6 years. *Journal of Clinical Periodontology* 8: 239-248.

Axelsson P, Lindhe J, Nyström B (1991). On the prevention of caries and periodontal disease. Results of a 15 year longitudinal study in adults. *Journal of Clinical Periodontology* 18: 182-189.

The Axelsson and Lindhe studies (2, 3, and 4) appear to be the only previous long-term prospective and successful clinical trial in adults. The purpose of these studies was to determine if caries incidence and recurrence, and the incidence and progression of periodontal disease could be prevented and maintained by the long-term maintenance of a high level of personal oral hygiene. In 1971-72, 375 adults in Karlstad, Sweden, were recruited to a test group and 180 to a control group. Individuals were recruited by two means: first, by being recalled from a list of three general private practitioners or, second, called from the waiting list of three public dental health clinics. Only individuals who had pursued and received dental treatment at least once a year during the last five years were included in the study. Participants within each group were divided into three age groups: less than 35 years (group 1), 36 to 50 (group 2), and more than 50 years old (group 3).

At the baseline examination, participants of both groups were assessed regarding their oral hygiene, gingivitis, periodontal disease, and dental caries status. Subsequent to the baseline examination, all caries lesions were treated and defective restorations were adjusted. In addition, "each patient received a detailed case presentation and a dental prophylaxis". Participants in the control group were recalled every year to a public dental health clinic for examination and treatment of symptomatic teeth. Whereas, participants in the test group received a preventive program carried out by a dental hygienist, which included instruction and practice of oral hygiene techniques, and a comprehensive dental prophylaxis once every 2-3 months for the first 6 years. Each session required about 30 minutes, when plaque was disclosed, the Bass method of tooth brushing was demonstrated for each individual patient. Furthermore, patients were advised to use dental floss and toothpicks for interdental tooth cleaning. At each session, oral hygiene status was checked

and instruction was repeated. Sodium mono-fluoro-phosphate (Pepsodent ®) was used in the cleaning procedure. Caries examinations were performed once a year, however detailed re-examinations were performed three years and six years after baseline.

At the follow-up examination, three and six years after the baseline examination, the participants in the test group presented with noticeably improved oral hygiene. In all three age groups the plaque scores had decreased from 60% to 15-20%. However, in the control groups, there was no obvious improvement in oral hygiene status compared to baseline. For the control groups, at the 6-year examination, 7.6%, 11.7%, and 18%, of participants in groups 1, 2, and 3 respectively had all examined sites had "probing depths > 3 mm". During the first 6-year period, periodontal attachment gain was in the region of 0.2 mm in all test groups, contrasting with a variable loss from 0.8 to 1.6 mm among the control groups.

Caries examinations after six years revealed that, except for few individuals, participants in the test groups did not develop new carious lesions during the trial period. However, in the control group, 7.4, 5.4, and 4.2 new lesions developed during the same period in groups 1, 2, and 3, respectively. Recurrent caries was found in only few participants in the test groups. In the control groups, the average numbers of recurrent lesions after six years were 7.5, 9.8, and 7.7 for groups 1, 2, and 3, respectively. In summary, in the control groups there was a mean increase of 12 to 15 decayed surfaces (2.3 Ds/year/subject), and an overall mean loss of periodontal attachment of 1.2 mm (0.2 mm/surface/subject) during the six years, while the test groups had a low caries incidence and improved periodontal conditions.

For ethical reasons, the control group was ceased after the 6-year examination. During the following nine years the program features remained practically the same for the test group. However, the frequency of prophylaxis sessions varied according to participants' individual need for preventive therapy. For instance, 65% of individuals were recalled once a year, 30% twice a year, and 5% were recalled three to six times a year. This last group was considered at risk subjects, who had ...

"... loss of more than 1 mm of attachment on more than 1 interproximal tooth surface during the preceding 6-year period and/or developed more than one caries lesion during the course of any of the 6 preceding 12 months periods".

The re-examination performed in 1987 disclosed that the 317 subjects, who participated during the entire 15-year period, had a low incidence of caries and almost no further loss of periodontal tissue support. One hundred and sixty five participants (> 50%)

did not develop additional caries during the 15-year interval, 34 participants developed more than two new caries surfaces, and only two participants developed more than 10 caries lesions. A caries incidence of zero was observed in 80%, 55%, and 30% of participants in groups 1, 2, and 3, respectively. The overall mean number of new carious lesions varied from 0.1 to 0.3 during the 15-year period, and the corresponding values for recurrent caries were 0.7 and 0.9.

Only 2-3% of all gingival sites bled on probing at the base of the pocket, compared with 20-25% at baseline. The mean probing depth for buccal and lingual surfaces was around 1 mm, while the corresponding depth at interproximal surfaces was 2 mm at the 15-year examination. These results were compared to baseline values of 1.4 and 1.7 mm for buccal and lingual surfaces, and 2.7 mm for interproximal sites. There was an overall attachment gain of 0.3 mm in the 317 subjects in relation to the values obtained from the 1972 examination. In particular, there was a significant gain of attachment at both interproximal and lingual surfaces, which varied from 0.2 and 0.5 mm in all age groups.

In addition, tooth loss was also observed. There was an overall net loss of 0.2 teeth per subject in all three groups. Out of 317 participants, 51 subjects lost 1 tooth, 5 subjects lost 2 teeth, 2 subjects lost 3 teeth, and 1 subject lost 4 teeth. In summary, a total of 71 teeth were lost. The main reason for tooth loss was root fracture, which occurred in 48 teeth. It was explained that the lost teeth had root therapy and cast posts prior the baseline examination. Two teeth were lost due to recurrent caries, and six teeth were extracted because of marginal abscess development in furcation-involved molars. According to the authors, the results suggested that "improved self performed oral hygiene, daily use of fluoride dentifrice, and regularly repeated professional tooth cleaning effectively prevented recurrence of dental disease."

Katz S (1982). The use of fluoride and chlorhexidine for the prevention of radiation caries. Journal of American Dental Association 104: 164-170.

This study had two main objectives: to determine if the combination of fluoride and chlorhexidine could prevent the increase in caries susceptibility following orofacial irradiation (1), and to observe if a protocol could be followed by individuals at home (2). A total number of 71 cancer patients, who were receiving radiation treatment in a few hospitals in Madrid, Spain, accepted to participate in this study. Out of those 71, 35 patients who were receiving radiotherapy, supplemented by chemotherapy in some occasions, or surgery, or both, for malignancies of the head and neck, were observed from six to ten months. These patients were divided into 3 groups. Patients were randomly assigned to groups 1 and 2, however group 3 was composed of patients who presented better oral hygiene and fewer cavities. Group 1 received professional 4-minute topical applications of 1.0% sodium fluoride and 1.0% chlorhexidine solution once a week for four weeks, and daily mouthrinsing with 0.05% sodium fluoride and 0.2% chlorhexidine solution for one minute. On the other hand, group 2 received the same rinse solution as group 1 but did not receive any topical application. Group 3 received professional 4-minute topical applications of 1.23% acidulated phosphate fluoride gel once a week for four weeks, and mouthrinsing with 0.05% sodium fluoride for one minute every night. Results showed that the treatment received by group 1 was able to prevent radiation caries completely. The DMFS caries decrement during the treatment period was -1.81 and a negative caries increment of -1.44 DMFT was also observed (negative meaning that remineralization exceeded demineralization). Regarding group 3, there was an increase of new carious lesions which was represented by a DMFT and DMFS increments of +1.45 and 1.91, respectively. The monthly caries increment in each group were also reported as -0.27, 0.02, 0.35 in relation to groups 1, 2, and 3, respectively.

Johansen E, Papas A, Fong W, Olsen TO (1987). Remineralization of carious lesions in elderly patients. Gerodontology 3:47-50.

The purpose of this study was to "simultaneously increase tooth resistance, decrease the acid attack rate, and enhance the intraoral and physiological maintenance process". This study reported results based on two independent projects which followed the same protocol: project I- private practice study, and project II- Tufts study. Project I was carried out in a private practice environment in Wyoming County, a rural community in Northwestern New York State. The piped water was not fluoridated, and the majority of dwellers in this district had a high caries incidence. A total of 30 patients, aged 45 years

and older were followed. They were divided into two groups. Group A was composed of medically compromised patients such as cancer, Parkinsons' disease, and group B was composed of 12 healthy subjects. The majority of patients in project I presented active cervical caries at the beginning of the study. Project II was performed at Tufts University School of Dental Medicine, in Boston, Massachussets. This program included patients that were referred to the program because of their high caries incidence, and data on 94 patients aged 45 years or older were described. The high caries risk of participants at the Tufts School of Dental Medicine was due to radiation therapy, xerostomia, Sjögren's syndrome or they were otherwise described as having "high caries susceptibility". At both sites, a dental prophylaxis and detailed oral examination was given to patients preceding the program, and afterwards patients were seen at three to six month intervals. The preventive activities were explained and demonstrated to patients, and written instructions were provided. In summary, the preventive procedures included (1) oral hygiene including flossing, standardized toothbrushing with fluoride toothpaste, and cleaning of tooth surfaces with cotton swabs, (2) self application of 1% neutral sodium fluoride gel in a customized tray for 5 minutes twice a day during the first 2 weeks followed by a daily application for another 2 weeks, (3) remineralizing mouthwash (5mM calcium, 3mM phosphate, and 0.25 mM (5ppm) fluoride) for 2 minutes after each topical fluoride application, and (4) salivary gland stimulation by chewing a sugar free gum specially prepared and prescribed for xerostomic patients. Results from the private practice study revealed that after 4 years, 56% of active caries lesions had remineralized. In the Tufts study, 51% of coronal surfaces and 77% of root surfaces had remineralized. For 23 radiation therapy patients, all 243 carious surfaces had remineralized. Most importantly, the incidence of new carious lesions in both projects dropped close to zero. The authors asserted that the near zero caries incidence may be due to the remarkable change in the chemistry of the dental tissues following the 4 to 6 weeks treatment combining topical applications of fluoride and the remineralizing mouthrinse.

De Paola PF (1993). Caries in our aging population: What are we learning? In: Bowen WH, Tabak LA (editors). *Cariology for the nineties*. Rochester: Rochester University Press, 25-35.

This randomised controlled trial conducted in Boston, USA, included 71 participants, who were randomly allocated to a treatment (35 participants, mean age of 72 years) and a control group (36 participants, mean age of 68 years). The aim of the study was to measure the effect upon buccal root surface caries lesions of the daily self-application of 5000 ppm sodium fluoride gel in conjunction with the periodic professional application of 12000 ppm neutral sodium fluoride gel. The lesions were divided into three categories: C₁, C₂, and AC.

“ ... A C₁ lesion is a well defined softened area, yellowish or light brown in color, but without cavitation, i.e. the morphological integrity of the surface is not disturbed.

Penetration by explorer is possible. A C₂ lesion is a softened area, yellowish or light brown in colour with a disruption of the surface contour. Penetration by explorer is possible. An AC lesion or, arrested caries lesion, is a darkly stained almost black area with a leathery consistency; there may or may not be cavitation. There is little if any penetration by explorer.”

The treatment group received applications of 12000 ppm neutral sodium fluoride gel, while the control group received applications of placebo gel on root surfaces. The applications were of two minutes duration in both groups, and were applied at baseline, after four months, after eight months and after twelve months, when root lesions were reassessed. After the baseline application, participants received hands-on instruction in proper brushing, flossing and the use of self-applied fluoride gel formulation. In addition the test group received a four month supply of the 5000 ppm gel; the control group received a placebo gel. Toothbrushes and fluoride dentifrice were given to all participants. During the recall appointments, oral hygiene procedures were reviewed, home care materials resupplied, and subjects received remuneration for their participation in the study.

Results revealed that in the control group, 18 % of C₁ lesions had arrested after 4 months, while in the treatment group 39% of C₁ lesions had arrested in the same period of time. After 8 months, the values were 28% in the controls and 95% in the treatment group. Finally, at 12 months 40% of C₁ lesions had arrested in the control group, whereas 91% of C₁ lesions had arrested in the treatment group. Regarding C₂ lesions, only 8% were arrested after 12 months. On the other hand, for the treatment group 13%, 53%, and 57% C₂ lesions were arrested after 4, 8, and 12 months, respectively. Since all lesions were active at baseline, it was demonstrated that a large percentage of lesions could be arrested

with ease. The authors considered that the success was due to the motivational program that included intensive oral hygiene instruction and direction to give special attention to the carious lesions while brushing. Other point of interest was that caries arrest occurred in the control group, which did not benefit from the active fluoride gel professionally applied but only from the intensive oral hygiene program, which included twice daily use of fluoride dentifrice. Therefore, a rational assumption was that "most, if not all subjects in this study brushed their teeth more meticulously, with a greater regularity, and with greater attention to diseased areas, than was their usual custom".

Fure S, Gahnberg L, Birkhed D (1998). A comparison of four home-care fluoride programs on the caries incidence in the elderly. *Gerodontology* 15:51-60. The authors of this study were concerned that caries incidence was increasing in very elderly people. It appears that they were investigating whether better use might be made of existing preventive agents. The objective of the study was to assess the caries preventive effect of four fluoride programs over 2 years in elderly people. One hundred and sixty-four patients at risk of caries, aged 60 years and older, who attended for a regular dental examination at either the public dental clinic of Bålsta or Knivsta in the district of Uppsala, or at the Faculty of Dentistry in Göteborg, Sweden, were included in the study. The fluoride concentration in the drinking water was 0.2, 0.1, and 0.1 ppm in the locations cited above, respectively. Participants were randomly assigned to four groups. Group 1 (n=49, rinsing group) rinsed twice a day after a meal with a 0.05% sodium fluoride solution, group 2 (n=51, tablet group) sucked twice a day on a 1.66 mg sodium fluoride tablet, group 3 (n=32, slurry group) brushed their teeth three times a day using a toothpaste-slurry rinsing technique.

"... the participants were instructed to brush their teeth three times a day (1, after breakfast, 2, after lunch or dinner, and 3, before bedtime), using a special toothpaste technique. They were told not to spit out more dentifrice than necessary during toothbrushing and not to rinse. They were then asked to use the remaining dentifrice foam, together with a sip of water, and to swish the toothpaste slurry around their dentition for one minute. No further water rinsing was recommended afterwards."

Group 4 (n=32, control group) brushed their teeth in their usual manner. All participants used a fluoride toothpaste (0.32% sodium fluoride) at least twice daily. Patients were recalled every 6 months to reinforce the instructions previously given at baseline. Results after two years showed no significant differences in mean caries increment between the experimental groups. Among 164 participants, zero increments in

carious lesions were found in all groups but at different rates as follows: 67% (rinsing group), 43% (tablet group), 25% (slurry group), and 16% (control group). The respective mean 2-year group caries increments were 0.8, 1.4, 1.9, and 2.3. The differences in caries increment between the control and the other groups were significant only for the rinsing group ($p < 0.001$).

Mojon P, Rentsch A, Budtz-Jørgensen E, Baehni PC (1998). Effects of an oral health program on selected clinical parameters and salivary bacteria in long-term care facility. *European Journal of Oral Science* 106: 827-34.

The purpose of this controlled clinical trial was to evaluate clinically and microbiologically the effect of a preventive oral health program on caries incidence. This program included information about caries-preventive measures, professional tooth cleaning, and fluoride toothpaste. A total of 116 elderly patients, 65 years or older, in a assisted-living facility in Geneva, Switzerland, were included in the study; half of them composed the experimental group. Many participants were dependant on care-givers for daily activities. The experimental group benefited from a preventive program. Information on oral disease prevention, aetiology of dental caries and periodontal disease, basic principles of oral health, and dietary advice was given to 8-10 health-care providers by a dental hygienist. These personnel received a practical demonstration on how to brush the teeth of dependents participants during a lecture. In addition, dental prophylaxis including scaling was provided to the participants of the experimental group. Participants also received oral hygiene instruction, and depending on dependency level, caregivers were also instructed. Recall appointments were made according to participant's needs; a maximum of 6 months between visits was established. Fluoride toothpaste and toothbrushes were given to participants during the study period. The control group did not benefit from any preventive procedure, but a dentist at the request of the resident, family or caregiver treated them. Oral examinations and microbiological sampling were performed at baseline and 18 months later. Results after one and a half years showed that the plaque index was statistically similar compared to baseline in both groups. However, in the experimental group, mutans streptococci counts, and lactobacillus counts were lower after 18 months. Importantly, compared to the control group, secondary caries were 55% less in the test group, and root caries were 16% less.

Powell LV, Persson RE, Kiyak HA, Hujoel PP (1999). Caries prevention in a community-dwelling older population. *Caries Research* 33: 333-9.

The aim of this clinical trial was to compare the effect of usual and customary caries-preventive strategies on caries progression. The study population was 297 low-income, ethnically diverse subjects, aged 60 years or more. The participants were recruited from the local Public Health Department in Seattle, USA, and from community programs. Participants were randomly assigned to one of the four experimental groups or to a control group. The control group (group 1) received usual care from a public department or a private practitioner. Group 2 received educational group sessions of two hours of duration twice a year. Group 3 received the educational program as for group 2 along with a weekly 0.12 % chlorhexidine rinse. Group 4 received the same as group 3 as well as fluoride varnish application by a dental hygienist twice a year. Group 5 received all the above mentioned interventions and scaling and root planning by a dental hygienist every six months during the 3-year study period. All participants in groups 3, 4, and 5 were phoned monthly to reinforce regular use of chlorhexidine, and to remind them to attend the educational sessions. Results after three years showed that there were no statistically significant differences among the experimental groups regarding coronal caries, but it was observed that for groups who used chlorhexidine (groups 3, 4, and 5) the trend for developing coronal caries was less. Root caries also followed the same trend, that is, less root caries in groups that received chlorhexidine. However, the 23% reduction was not statistically significant. The authors suggested that the failure of the program was due to several reasons such as: the lesser effect of chlorhexidine rinse on dental caries because of the low concentration used (0.12% instead of 0.2%), low viability of chlorhexidine rinse when compared to varnish, the low intensity of chlorhexidine rinses (weekly rather than daily), the lack of efficiency of fluoride varnish in high caries activity populations, and the low intensity of the applications (twice instead of three times a year). Authors have reported that this low intensity protocol was used in order to improve long-term compliance, to reduce staining, to reduce program cost, and because of preliminary studies had indicated that weekly chlorhexidine rinses resulted in bacterial reductions similar to that achieved with daily rinses.

Rosén B, Olavi G, Bikhed D, Edvardsson S, Egelberg J (1999). : Effect of different frequencies of preventive maintenance treatment on periodontal conditions. five-year observations in general dentistry patients. *Journal of Clinical Periodontology* 26: 225 - 233.

Rosén B, Olavi G, Bikhed D, Edvardsson S, Egelberg J (2004). Effect of different frequencies of preventive maintenance treatment on dental caries: five-year observations in general dentistry patients. *Acta Odontologica Scandinavica* 62:282-288.

The purpose of this study was to evaluate the relative effectiveness of dental prophylaxis treatment scheduled at every 3rd, 6th, and 12th or 18th month on the progression of dental caries and periodontal disease in adults. After the initial examination, three age groups were formed: 21-34 years, 35-49 years, and 50 years or older. Subjects (259) were then divided into the four experimental groups. The study was conducted between 1983 and 1990 at a public dental clinic in Kävlinge, Sweden. An initial examination was performed; all participants received necessary preventive, periodontal, and restorative treatment. The baseline examination was carried out around three months after conclusion of this initial treatment. During the subsequent period, the participants were recalled for preventive treatments at intervals of 3, 6, 12, and 18 months, respectively. Examinations for data collection were done at three consecutive 18-month intervals for the 3, 6, and 18-month recall groups, and at four consecutive 12-month intervals for the 12-month recall group. The preventive procedures at each recall session included dental health information, oral hygiene instruction, dietary advice, supra and sub-gingival scaling, tooth polishing, and topical application of fluoride varnish. The recommended personal oral hygiene aids included fluoride toothpaste, soft toothbrushes, interdental brushes, triangular toothpicks, and dental floss. Results after five years were reported regarding tooth loss and mean caries increment. Tooth loss from the baseline to final examination was low for all three groups: in the 3-month group, 1 subject lost 1 tooth; in the 6-month group, 4 subjects lost 1 tooth and 1 subject lost 2 teeth; and in the 18-month group 2 subjects lost 1 tooth and 1 subject lost 2 teeth. The 5-year caries increment for participants in groups 3-, 6-, and 18-month groups was not statistically different at any of the surfaces or for total caries score. The development of root caries at any examination during the study period was also similar among the three groups, and the corresponding values were 24%, 18%, 26% (chi-square not statistically significant). The results from a multiple regression analysis showed factors having statistical significance (41% of the variation) in relation to caries increment were percentage of filled surfaces at baseline, dietary score, plaque score, and number of streptococci mutans and lactobacilli. The frequency levels for the 5-year caries increment among all 105 experimental subjects showed that 18 developed no carious lesions at all,

36 developed 1-3 lesions, and three developed 19-23 lesions. Comparisons between the 18 subjects who showed no new carious lesions during the 5-year observation interval and the 18 that showed the highest increment among the 105 participants were reported.

Statistically significant differences between the two extreme groups were observed in relation to percentage of filled surfaces at the initial examination ($p<0.01$), salivary secretion rate ($p<0.05$) and buffer capacity ($p<0.05$), numbers of mutans streptococci ($p<0.001$) and lactobacilli ($p<0.001$), plaque score ($p<0.05$), and bleeding on probing ($p<0.01$). The statistical analyses failed to demonstrate differences between the groups for either changes of probing depths or probing attachment levels. Authors concluded that “preventive treatments as often as 3-6 months may not be justified in the case of patients with low to moderate caries activity”.

Conclusions in relation to caries preventive programs for adults

The caries preventive programs for adults included a variety of preventive agents. The main difference between the programs was the length of follow-up. Long-term studies may be considered as those that were followed-up for more than five years, and up to five years for short-term studies. There was only one long-term study (over 15 years) and it was effective in demonstrating the almost complete elimination of disease activity during the maintenance follow-up period. Among the short-term studies it was demonstrated that: (1) even in extreme conditions of radiation and root caries, the carious lesions can be arrested and/or reversed by frequent topical fluoride applications and recalls of up to four times a year; (2) tooth brushing with fluoride toothpaste twice a day associated with fluoride rinsing at other times (after meals) showed a significant reduction in caries increment; and (3) that a combination of oral health education, oral hygiene instruction and dental prophylaxis twice a year was not effective in reducing coronal caries incidence.

The success of the long-term study (Axelsson et al., 1991) indicated that it is possible to arrest caries and to sustain this favourable outcome indefinitely. The results from the short-term studies show that dental caries arrest can occur quickly, however the challenge is to maintain monitoring programs and the motivation of patients to continue with good home care. It is more likely that the success obtained in the long-term study and in the effective short-term studies was due to the intensity of the preventive programs, meaning the frequent professional topical fluoride applications, strict monitoring of disease activity, conscientious individual oral hygiene coaching, and oral health education by a highly motivated personnel.

Summary of preventive programs for schoolchildren and adolescents

The following summaries of preventive programs refer to studies that included schoolchildren and adolescents aged eleven to fifteen years.

Axelsson P and Lindhe J (1977). The effect of a plaque control program on gingivitis and dental caries in schoolchildren. Journal of Dental Research. Special Issue C, 56: 142-148.

The purpose of this study was to evaluate the effect of a strict plaque control program on gingivitis and dental caries in schoolchildren aged seven to 14 years in Karlstad, Sweden. This summary will refer only to schoolchildren aged 13 to 14 years. The children were divided into test (n=23) and control (n=23) groups. At the baseline examination, both groups were examined in relation to oral hygiene status, gingivitis, caries experience, and they received restorative treatment and defective fillings were adjusted. The control group participated in a monthly-supervised school-based brushing program with sodium fluoride solution; they were recalled once a year for routine examination and treatment. Children in the test group received a preventive program that included: (1) detailed information on the aetiology and prevention of dental caries and periodontal disease, (2) oral hygiene instruction, and (3) scaling and dental prophylaxis using mono-fluor-phosphate paste (Pepsodent ®) every two weeks for first two years, every month for year 3, and every two months for year 4. Parents of children in test group received oral health education during meetings, parents' support was encouraged during the program, and at the end of every year they received a feedback on the study results. Results after four years were presented for caries increment, plaque and the Gingival Index. Caries increment was 0.77 DMFS (test) and 15.40 DMFS (control). Gingivitis was almost completely eliminated in children in the test group.

The authors demonstrated that in children at a very high risk of caries, a prophylactic program based on strict plaque control together with topical fluoride application (prophylactic paste) was able to prevent the incidence and recurrence of dental caries and gingivitis almost completely.

Melsen B, Algerbaeck N (1980). Effect of a instructional motivation program on oral health in Danish adolescents after 1 and 2 years. *Community Dentistry and Oral Epidemiology* 8:72-78.

This 2-year study evaluated the effect of an intensive motivation program in the oral health of 11-15-year-old schoolchildren in a Danish town. The drinking water contained less than 0.1 ppm of fluoride, but children participated in a fortnightly mouthrinsing with 0.2% sodium fluoride. The majority of children received dental care every six months through the municipal oral health program; they had not previously been exposed to a preventive program. Children were examined clinically for dental plaque, gingivitis, and dental caries at baseline and after one and two years. Children were randomly assigned to a test (n=81) and a control group (n=83). The control group did not participate in the motivation program. The test group received the preventive program, which was administered by a dental hygienist and included fortnightly 15-20 minutes sessions with eight to ten children during the first year. These sessions were composed of instructions, games, experiments, lectures, and discussions. Teachers were involved to increase motivation levels during regular lectures. At the end, the children level of knowledge regarding aetiology and pathogenesis of dental caries and periodontal disease, (2) on the influence of diet, and (3) on oral hygiene was examined through a questionnaire. This questionnaire was given to all children participating in the study.

During the second year, the motivation program took place once a month, and was similar to what happened in the previous year. The aim of the program was to create a variety of activities to completely engage the children. In addition, the test group was supplemented with children from another school, who were no longer included in the public schools dentistry program, in order to establish a competition among schools. The school which demonstrated the greatest improvement in oral hygiene would receive a sum of money to be used for a school party. Results after the 12 and 24 months examinations showed no statistically significant differences between test and control groups in relation to either dental caries increments or number of new surfaces filled. Children attending the public school dentistry program showed no improvement in oral hygiene as reflected by the plaque and gingival index. However, there was a statistically significant improvement in the Gingival Index in the children who were no longer included in the dentistry school program ($p=0.05$). According to the authors, this lack of improvement from children who were receiving school dental care and the motivation program may have occurred because of an "oversaturation" and consequently did not result in any improvement. The authors

concluded that an adequate level of knowledge as well as a positive attitude towards dental care did not change children behaviour.

Craig EW, Suckling W, and Pearce EIF(1981). The effect of a preventive program on dental plaque and caries in school children. *New Zealand Dental Journal* 77:89-93. This program tested a caries-preventive program based on the successful plaque control system described by Axelsson and Lindhe (3,4,5) under practical working conditions within the New Zealand School Dental Service. Children, aged 11-12 years, who attended school in a non-fluoridated area were divided into a test (n=55), a test-fluoride (n=54), and a control (n=55) group. The test group received dental prophylaxis and oral hygiene instruction from a dental nurse every two weeks. The test-fluoride group received the same treatment as the test group plus a 2-minute mouth rinse with 0.2% sodium fluoride every two weeks. The third group acted as a control. Results at the end of the 21-month trial disclosed that the test group had a non-significant reduction of 10% in caries increment. However, the test-fluoride group showed a 38% ($p<0.05$) reduction in caries increment. Plaque experience showed no improvement in either three groups. The authors concluded that the development of new carious lesions in any of the three groups was related to previous caries experience.

Zickert I, Lindvall AM, Axelsson P (1982). Effect on caries and gingivitis of a preventive program based on oral hygiene measures and fluoride application. *Community Dentistry and Oral Epidemiology* 10:289-295. The objective of this study was to investigate the effect on gingivitis and dental caries in schoolchildren of a plaque control program (1) delivered at different intervals, and (2) supplemented with topical application of two different fluoride agents (NaF and MFP). Children, aged 13-14 years, from two elementary schools in Arvika, Sweden were recruited for the trial. Children were examined clinically and radiographically in the beginning of the study, and after one, and two years. Following the pre-experimental examination children were divided into five groups: two main test groups (I and II). Children in group I were recalled for preventive treatment once a month, whereas children in group II received a dental prophylaxis every three months. At each preventive session, children in both groups received oral hygiene instruction, and professional tooth cleaning with a non-fluoride abrasive paste. Following professional tooth cleaning, children rinsed their mouths for two minutes and were supplied with toothpaste for home use. In addition, children in groups I and II were divided into three subgroups (A, B, C); they received different types of fluoride therapy during the two years of the trial. Group A used a 0.2%

sodium fluoride mouth rinse and toothpaste, group B used a 0.8% sodium mono-fluor-phosphate rinse and toothpaste, and group C used a placebo combination.

At the examinations after one and two years, the oral hygiene status of children in both groups had noticeably improved in comparison to the baseline data. Children in group I presented a reduction in the mean number of surfaces harbouring plaque from 75-80% to 53-56% after one year, and to 34-37% after two years. The corresponding values for children in group II were 73-79% to 58-63% after one year, and 35-43% after two years. The percentage of plaque-free surfaces was much higher on buccal and lingual surfaces than on proximal surfaces. The differences between groups II and I were statistically significant only after one year; after two years the improvement in oral hygiene was equally good in all groups. The percentage of gingival inflammation in group I decreased from 38-39% to 22-25% after one year and to 8-12% after two years. The corresponding values for group II were 32-40%, 23%, and 11-13%. The degree of improvement of gingival status was significant for each subgroup (A, B, C), but there was no statistical difference between groups II and I.

Caries examinations revealed that within subgroups A, B, and C, caries development was similar in children receiving professional tooth cleaning once a month (group I) or at every three months (group II). However, a statistically significant difference was observed regarding caries incidence between children who used sodium fluoride applications (groups I and II, A) and children using sodium mono-fluor-phosphate (groups I and II, B) in comparison with children who used a placebo compound (groups I and II, C); there was a 40 to 46% reduction in caries incidence for fluoride containing programs. It was noted that in both groups there were children who had caries increment of more than 11 new lesions. In summary, 10% of children developed 11-27 new carious lesions during the two years, and the majority of them were in the placebo group (65%). Children who did not develop any new carious lesions were equally distributed among the different groups. The authors confirmed that professional tooth cleaning combined with detailed oral hygiene instructions repeated either once a month or every three months over a period of two years was able to improve oral hygiene status and reduce clinical signs of inflammation; the combination of fluoride mouth rinse and fluoride toothpaste significantly reduced the caries incidence.

Klimek J, Prinz H, Hellwig E, Ahrens G (1985). Effect of a preventive program based on professional toothcleaning and fluoride application on caries and gingivitis. *Community Dentistry and Oral Epidemiology* 13:295-298.

This study was carried out in Marburg (< 0.2 ppm F), Germany, where the researchers adapted school programs from Scandinavian countries to their specific conditions; Germany did not have a school dental service. The objective was to evaluate the effect of this program on gingivitis and caries in schoolchildren, aged 12-14 years old, after three years. This program included five dental prophylaxis sessions per year and application of fluoride varnish twice a year. Children from three different secondary schools were assigned to a test group (n=104) and to a control group (117). Children in the control group received no prophylactic treatment; dietary advice was not given to either group. After four visits in the first six weeks, all children in the test group visited the dental hygienist five times a year for professional a prophylaxis and oral hygiene instruction. Each session included disclosing of dental plaque, individual demonstration of tooth brushing and flossing, and professional tooth cleaning with an abrasive paste that did not contain fluoride. In addition, fluoride varnish (Duraphat ®) was applied twice a year. Children in the test group were supplied with large quantities of toothpaste, toothbrushes, and dental floss. Clinical and radiographic examinations were performed at baseline and after two years for both groups.

Results after two years showed caries reduction of 46% and a reduction of Plaque and Gingival Indices around 60%. The total DFS increment in the test group was 2.7 and 5.0 in the control group. The highest caries reduction was found on proximal surfaces (59% in relation to the mean); lower reductions were observed on occlusal (40%) and bucco-lingual surfaces (35%). In addition, 37.5% of children in the test group had developed no new DF surfaces, but in the control group only 18.8% of children had no new DF surfaces. In addition, there was a remarkable reduction in both the plaque and Gingival Index of children in the test group (67% and 55%, respectively). According to the authors, the program demonstrated that a dental prophylaxis, repeated five times a year, and fluoride varnish applications twice a year were able to reduce the caries increment among schoolchildren; however it was not possible to distinguish which measure was more important.

Seppä L, Hausen H, Pöllänen L, Kärkkäinen S, Helasharju K (1991). Effect of intensified caries prevention on approximal caries in adolescents with high caries risk. *Caries Research* 25: 392-5.

All 13-year-olds living in Kuopio, Finland, who had high levels of salivary streptococci or a DS score > 0 were invited to participate in this study. The aim of this study was to evaluate the effect of two preventive programs performed in public dental clinics in Kuopio, which has fluoridated piped water (1.0 ppm F). Parents gave informed consent for 265 children to participate in the study. After the baseline examination, these children were randomly divided into two groups. Group 1 continued to receive the standard treatment offered by the clinics, which included intensified health education, fluoride varnish applications, and fissure sealants. The other high risk children (group 2) received an intensified preventive program, which included (1) frequent dental check-ups, (2) fissure sealants, (3) fluoride varnish applications three times a year, (4) oral hygiene instruction, (5) professional prophylaxis, (6) intensive dietary counselling, and (7) monitoring of the level of mutans streptococci using the Dentocult SM ® system. Dentists were instructed to delegate as many of the preventive procedures as possible to dental hygienists. For comparison, half of the 13-year-olds with low caries risk, who were not included in the study, acted as a control group (group 3).

Results after two years revealed mean approximal caries increments of 2.6, and 2.3 in the risk groups, respectively. The increment in the two high risk groups was three times higher than that of the low risk group. There was no significant difference between the two high risk groups despite the fact that group 2 received more intensive preventive procedures compared to group 1. According to the authors, the results indicated that "caries prevention targeted for high risk groups failed to lower the rate of caries to the same level as that of the children with an anticipated low risk. For children at high risk, the intensified prevention program monitored by dental authorities was no more successful than prevention planned by individual dentists." The authors suggested that the failure of the program might be due to a variation in the preventive procedures carried out in different clinics. In this program and contrary to the instructions, the preventive procedures were mainly performed by dentists and not by dental hygienists. The use of microbial tests was minimal and might have influenced the effect of dietary counselling; the average low caries increment even in the high risk children may have interfered in the results. It was speculated that if dental hygienists, who are specially trained to deliver intensive preventive care, had delivered the programs, the results might have been better.

Axelsson P, Buischi YAP, Barbosa MFZ, Karlsson R, Prado MCB (1994). The effect of new oral hygiene training program on approximal caries in 12-15- year-old brazilian children: results after three years. *Advanced Dental Research* 8(2): 278-284, July. This study was known as the "São Paulo study" and its goal was to evaluate the effects of a needs-related oral hygiene training program on approximal caries in 12-year-old Brazilian schoolchildren with a well-established habit of daily tooth brushing with fluoride toothpaste. Children were exposed to fluoridated water since the end of 1985. The participants' oral health status was examined clinically and radiographically at baseline and annually during the 3-year experimental period. After the baseline examination, children were randomly assigned to two test groups (79 in group I, and 72 in group II), and to one control group (n=71, group III). Group I received a comprehensive oral hygiene training program including group sessions for discussion regarding the pathogenesis of dental diseases, and the role of self-diagnosis and self-care in the prevention and control of caries and gingivitis.; parents and teachers received a 1-hour lecture on the aetiology of dental caries and prevention of dental diseases. Oral hygiene training sessions included:

"... repetition of information on aetiology and development of dental diseases, self-diagnosis of initial caries and gingivitis in the mouth, dietary counselling aimed at restriction of sugar intake and frequency, recording of (1) bleeding gingival units, (2) incipient caries lesions, and (3) plaque; with a copy of the chart taken home as a motivational tool, and self-diagnosis of plaque and plaque formation rate after disclosure by erythrosin, followed by oral hygiene instruction and supervised training according to the individual distribution of plaque and dental diseases, and self-identification of the key-risk teeth and surfaces."

The first three visits were scheduled at a two day interval; after children were recalled monthly for four months and at every three months until the end of the study. During the recall visits, children in group I were oriented regarding their difficulties involving self-diagnosis and tooth brushing performance; training and information was also reinforced at each session.

Children in group II received repeated traditional oral hygiene instruction on an individual basis, with the same frequency as group 1, as described above. However, there were no group sessions, and motivation; self-diagnosis and active participation was not stimulated. Children in group III received no information or instruction. All participants in groups II, III, and I were monthly supplied with toothbrush, fluoride toothpaste, dental tape, and dental floss during the entire 3-year study period. Results after three years disclosed the mean new approximal DFS for group I was around 50% less than for the

other two groups. The basic principles of self-diagnosis and evaluation illustrated a probable reason why children in group I developed significantly fewer new approximal carious lesions compared to the other two groups.

Hausen H, Kärkkäinen S, Seppä L (2000). Application of the high risk strategy to control dental caries. *Community Dentistry and Oral Epidemiology* 28:26-34.

The purpose of this study was to evaluate whether a population of 12-years-old with low overall caries frequency benefits when prevention is targeted at high risk groups. Sixth grade classes of schools in the city of Vantaa, Finland, were selected to participate in the study. Based on data from clinical examination and salivary tests, 511 high-risk children were randomized into two groups. Half of them received the preventive treatment and the other half received the same basic prevention given to the low-risk children. A random sample of 261 low-risk children were followed-up during the same period of three years as the high-risk children. The preventive treatment received by high-risk children included fluoride varnish applications (every 6 months); all newly erupted molars and pre-molars with deep fissures were sealed; dietary counselling; oral hygiene instruction and information reinforced at every visit; professional dental prophylaxis using chlorhexidine-fluoride gel (0.8% and 0.2%, respectively) applied with a rotating brush for five minutes for all those with mutans streptococci score 3 at baseline; toothbrushing twice a day with fluoride toothpaste and not rinsing after; fluoride lozenges to be used four times a day; xylitol chewing gum after meals were recommended. The basic prevention received by the other high-risk and the lower-risk children included fluoride varnish application once a year; sealants placement only on newly erupted second molars with deep fissures; principles of good oral hygiene and diet were mentioned but not in detail; tooth brushing with fluoride toothpaste twice a day. Results after three years revealed that despite all intensive preventive care, total DMFS increment of high-risk children groups was significantly higher than low-risk children (4.4 and 2.0, respectively). According to the authors, there was no additional benefit from an intensive preventive program when comparing caries increment in the two high-risk groups. They asserted that “by offering only basic prevention to all children, nearly the same preventive effect could have been obtained with substantially less effort and lower costs”.

Conclusions in relation to caries preventive programs for schoolchildren and adolescents

Among the previously described preventive programs, there was only one effective preventive program and it was able to almost completely prevent the recurrence of dental caries and gingivitis after year 1, and maintain that during the follow-up period. Being a pioneer, this program inspired others to do the same, however it is observed that there was a mix of results in the different trials. None of them was able to achieve such a successful outcome. At best, caries reduction of 50% was achieved. Programs based on oral health education were able to improve knowledge, but were not effective in changing behaviour and, consequently, did not have an impact on caries incidence. Other programs that were based on reinforcement of oral hygiene and topical fluoride application up to three times a year were not effective in reducing caries activity in a group of high risk adolescents.

The caries preventive programs for schoolchildren and adolescents revealed that caries arrest or reversal is dependent upon a combination of factors and not on individuals factors acting alone. An effective program for children must (1) involve parents, (2) provide opportunities for professional application of topical fluoride, and (3) must manage effective home-care plaque control using fluoride dentifrice.

Literature review table summary

The studies that have been reviewed are summarized in Table 1.

Table 1: Summary of studies of preventive programs for adults aged 21 years and older and schoolchildren and adolescents aged 11 to 15 years:

First Author, year, country	Follow-up	Age (years)	Sample size	Study design	F water (ppm)	Treatment, recall regularity	Control, recall regularity	Main result
1. Axelsson, 1978 1981 1991 Sweden	6 years 15 years	35 to 50 35 to 50	317 (test) 180 (control) 317 (test)	CT (control)	NR	Preventive program: detailed OHI + dental prophylaxis + F applications + oral health education at 5 to 6x year Same as above + recalls according to individual risk	F toothpaste + routine exam + treatment 1x year no control	Mean caries increment: 0.2-0.3 lesions (test); 11.9-15.1 lesions (control). Attachment: 0.2 mm gain (test); 0.8-1.6 loss (control) Caries incidence= 0; >50% subjects Overall attachment gain: 0.3 mm
2. Katz, 1982 Spain	10 months	45 to 55	35	NCT	NR	(1) 1% NaF gel (4x 4min) + 1% CHX solution weekly + 0.05% NaF + 0.2% CHX (daily rinse) (2) 0.05% NaF + 0.2% CHX (daily rinse) (3)(1.23% PO4F gel (4x 4min) + 0.05% NaF(daily rinse)		(1): prevented new lesions; remineralized incipient lesions (2): prevented new lesions; no remineralization
3. Johansen, 1987 USA	4 years	45+	124	NCT	NR	OHI 2 to 4x year + F toothpaste + 1% NaF gel (customized trays) 2x day for first 2 weeks + CaPO4F mouthwash after gel. Followed by 1% NaF gel 1x day for 2 weeks +CaPO4F mouthwash after		Caries incidence ≈ 0 Active lesions: 56% remineralized All lesions remineralized in 23 radiation therapy patients
4. De Paola, 1993 USA	1 year	68 to 72	71	RCT	NR	NaF gel (12000 ppm) application + OHI at baseline, after 4, 8, 12 months + Fgel (5000 ppm) daily self-applied + F toothpaste	Placebo gel + F toothpaste	Test: 91% C1 + 57% C2 lesions arrested Control: 40% C1 + 8% C2 lesions arrested where C1=non cavitated root lesions and C2=cavitated root lesions
5. Fure, 1998 Sweden	2 years	60+	164	RCT	0.1 - 0.2	(1) F toothpaste + NaF 0.05% rinse 2x day (2) F toothpaste + F tablet sucked 2x day (3) F toothpaste + Slurry tooth brushing 3x day	(4) F toothpaste + usual toothbrushing 2x day	Mean 2-year caries increment per group: (1) 0.8; (2)1.4; (3)1.9; (4) 2.3 (1) vs (4) p<0.01 Zero increments (% of patients per group): (1) 67% ;(2) 43%; (3) 25%; (control) 16%
6. Mojon, 1998 Switzerland	18 months	65+	116	CT	NR	Preventive program: oral health education + OHI given to care- givers + dental prophylaxis 2x year + F toothpaste	F toothpaste + usual treatment if symptomatic teeth.	Plaque Index: (test) 2.63; (control) 3.00 Changes in caries incidence: 55% less tooth fillings with secondary caries; 27% more active coronal caries; 15% less root caries

CT=controlled trial; NCT=non controlled trial; RCT=randomized controlled trial; OHI=oral hygiene instruction; F=fluoride; CHX=chlorhexidine; NR=not reported

First Author, year, country	Follow-up	Age (years)	Sample size	Study design	F water (ppm)	Treatment, recall regularity	Control, recall regularity	Main result
Adults								
7. Powell, 1999 USA	3 years	60+	297	RCT	NR	(2) Health education 2x year (3) same as group 2 + 0., 12% CHX weekly rinse (4) same as group 3 +F varnish 2x year (5) same as group 4 + dental prophylaxis and scaling	(1) Usual care	Coronal caries: 27% reduction (p=0.09) Root caries: 23% reduction (p=0.15)
8. Rosén, 1999 2004 Sweden	5 years	21 to 50+	259	NCT	NR	Preventive treatment for all groups: Oral health info + diet advice + dental prophylaxis + F varnish. Recalls at every 3rd, 6th, and 12th or 18th month, for groups 1, 2, 3, and 4.		Mean caries increment: (1) 4.4; (2) 4.0; (4) 4.9 Multiple regression analysis: 41% of variation in caries increment was related to previous caries experience. %of subject with attachment loss ≥1 mm: (1) 72%; (2) 93%; (3) 83%; (4) 86%
Schoolchildren and adolescents								
9. Axelsson, 1977 Sweden	4 years	13 to 14	46	CT	NR	Preventive program: detailed OHI + dental prophylaxis + F applications oral health education every 2 weeks for first 2 years, then every month at year 3 and every 2 months at year 4 Parents received oral health education and their support was encouraged	Routine exam + treatment once a year and monthly school supervised brushing program (NaF solution)	Mean caries increment after 4 years: 0.77 (test); 15.4 (control) Gingivitis was almost completely eliminated in children in test group
10. Melsen, 1980 Denmark	2 years	11 to 15	164	CT	>0.1	Oral health education+motivation program: games, lectures, discussions every 2 weeks	Did not participate in program.	Increase in caries incidence: 10% (test); 8% (control) Plaque and Gingival Index for test and control: ↑score 0: 12%, 1% (test); 16%, 6% (control) ↓score 2-3: 15%, 4% (test); 21%, 15% (control)
11. Craig, 1981 New Zealand	21 months	11 to 12	165	CT	NR	(1) Professional prophylaxis+ OHI every 2 weeks + F rinse(0.2% NaF) (2) Professional prophylaxis+ OHI every 2 weeks	(3) No intervention	Caries reduction: 38% in fluoride rinsing group Mean Plaque Index: (1) 2.1; (2) 2.2; (3) 2.5

CT=controlled trial; NCT=non controlled trial; RCT=randomized controlled trial; OHI=oral hygiene instruction; F=fluoride; CHX=chlorhexidine; NR=not reported

First Author, year, country	Follow-up years	Age (years)	Sample size	Study design	F water (ppm)	Treatment, recall regularity	Control, recall regularity	Main result
12. Zickert, 1982 Sweden	2 years	13 to 14	290	NCT	NR	Main group I: 1x month dental prophylaxis + (a) NaF toothpaste + 0.2 % NaF rinse+ OHI (b) MFP toothpaste + 0.8% MFP rinse + OHI (c) placebo toothpaste + placebo rinse Main group II: dental prophylaxis every 3 months		Main groups I and II: caries reduction of 40-46% for F containing groups Mean caries increment: Main group I: (a) 3.2; (b) 3.2; (c) 5.4 Main group II: (a) 3.8; (b) 4.2; (c) 7
13. Klimek, 1985 Germany	2 years	12 to 14	282	CT	<0.2 ppm	OHI + dental prophylaxis 5x year + F varnish 2x year + F toothpaste	No intervention	Mean DFS increment: 2.7 (test); 5.0 (control) Plaque and Gingival Index: ↓61% and ↓54%
14. Seppä, 1991 Finland	2 years	13	513	RCT	1	(2) High risk test: OHI + F varnish 3x year + sealant + dental prophylaxis + diet counselling + bacterial counts	(1) High risk group: health education + F varnish + sealant (3) Low risk group: No intervention	Mean approximal caries increment: (1) 2.6, (2) 2.3, (3) 0.7
15. Axelsson, 1994 Brazil	3 years	12 to 15	222	RCT	optimal	(1) Individual OHI and training (self diagnosis) + group discussions (oral health) + active parental support + parental oral health education+ copy of clinical chart (detailed case presentation) Recalls: first 3 visits at 2 day interval; then 1x month during 4 months; and then 4x year	(2) Individual OHI + recalls as for (1) (3) No OHI / education and recalls as for (1)	Mean approximal caries increment: (1) 2.3, (2) 4.7,(3) 5.3 ; (p<0.001)
16. Hausen, 2000 Finland	3 years	12	760	RCT	NR	High risk test: dental prophylaxis + OHI + F varnish 2x year + diet advice+sealant+ F lozenges 4x day + sugar free chewing gum after meals + F toothpaste	High risk control: OHI + F varnish 1x year + sealant + diet advice + F toothpaste Low risk group: same as above	Total mean DMFS increment: 4.4(test) ; 5.1 (control); 2.0 (low risk group)

Schoolchildren and adolescents

CT=controlled trial; NCT=non controlled trial; RCT=randomized controlled trial; OHI=oral hygiene instruction; F=fluoride; CHX=chlorhexidine; NR=not reported

PART 2

AN AUDIT OF THE CARIES MANAGEMENT AT THE CARIES MANAGEMENT CLINIC AT THE WESTMEAD CENTRE FOR ORAL HEALTH

INTRODUCTION

A combination of intensive topical fluoride applications, oral hygiene instruction, and monitoring has been shown to be effective in arresting and preventing dental caries and periodontal disease in high caries risk patients since 1977 (Axelsson, Lindhe, 1977, 1978, 1981; Axelsson, et al., 1991). Even in extreme conditions following radiotherapy, coronal and root caries increment were arrested and/or reversed by daily topical fluoride applications and follow-up monitoring appointments up to four times a year (Katz, 1982; Johansen, 1987; De Paola, 1993). However, the challenge is to maintain both the monitoring programs and the motivation of high risk patients to continue home care.

The need to shift the focus of health care at the Westmead Centre for Oral Health (WCOH)

An analysis of patient's folders at the Westmead Centre for Oral Health (WCOH) revealed that the focus of dental caries management is on restorative care, and not on the control of the disease causative factors. As a consequence, dental officers spend almost all their time in the clinics treating patients presenting with dental pain and immediate dental problems, instead of addressing the underlying disease by interfering with the causative factors (dental plaque, diet and lifestyle), and improving the protective factors (frequent topical fluoride application, oral health education regarding the use of fluoridated toothpaste, oral hygiene coaching). Indeed, because these dentists are repairing the consequences of the disease and not solving it, patients continue to be the biggest losers. The cycle of repair of a lesion, failure of the repair, or development of new lesions resulting in more repair or tooth loss may never end, unless a preventive and non-invasive approach is taken into account.

The establishment of the Caries Management Clinic (CMC)

A Caries Management Clinic (CMC), for high risk patients, was established in the General Practice Department, WCOH, to implement a set of protocols based on the Caries Management Policy, adopted by the Faculty of Dentistry, University of Sydney (see appendix A). There was no available data on caries incidence of patients attending the WCOH. In general, it may be understood that a patient at a high risk of caries is one who experiences more than one newly decayed area on a tooth per year. Typically, such patients experience two or more newly decayed areas.

The Caries Management Policy, Faculty of Dentistry

The Caries Management Policy was developed by the Curriculum Content Committee and adopted by the Faculty of Dentistry, University of Sydney, in 2003. This policy is centred on (1) the patient at risk, (2) the status of the carious lesion, (3) clinical management, and (4) monitoring. The purpose of this policy is (1) to prevent the occurrence of new decay on (a) existing sound surfaces and (b) along the susceptible filling margins, (2) to maintain the status of arrested lesions, and (3) to remineralize existing cavitated and non-cavitated lesions, where such remineralization, depending on lesion size, may be complete or partial.

The Caries Management System (CMS)

The Caries Management System (CMS) is a strategy that was designed to implement the Caries Management Policy. The philosophy of the Caries Management System (CMS) is to shift the focus of care towards the control of the causative factors of tooth decay, and to systematise a process, that will lead to the enhancement of both the natural repair of existing lesions and the prevention of new lesions. It differs from the traditional system for managing caries, which has its focus on the surgical removal of decayed tooth structure, and subsequent restoration with a suitable filling material.

The Audit

An audit of the caries management in the CMC was carried out from April to December 2005.

Purpose of the study and audit

The purpose of this study and audit was to implement the CMS within the newly established CMC, and to carry out an audit of associated clinical outcomes, such as, caries reduction, oral hygiene improvement, changes in patient motivation, and dietary change.

Hypothesis

The hypothesis to be tested is that the oral health and oral status of patients attending the CMC will not continue to deteriorate, as does that of many patients attending the General Practice Clinic at the WCOH which has, as its focus, the restoration of dental fitness through restorative (including exodontia where necessary) and prosthodontics care.

Ethics approval

Ethics approval (see appendix B) for the project was obtained from the Human Research Ethics Committee at the Sydney West Area Health Service and at the University of Sydney. Participation in the study was entirely voluntary and confidential. Patients received a participant information sheet, and signed a consent form (see appendix C). It was emphasized that one could drop out at any time, with no risk of discontinuing treatment.

MATERIAL AND METHODS

The Caries Management Clinic

The Caries Management Clinic (CMC) is held once a week in the fully equipped General Practice Department, Westmead Centre for Oral Health. Strict infection control regulations were followed during the study according to the standard procedures observed within the hospital clinics. Oral hygiene instruction was carried out in a separate room referred to as the oral hygiene bay. This room is a private room, and separated from the clinic itself. It is equipped with a basin, a wall mirror, educational materials, and samples of toothbrushes and toothpaste.

Patient recruitment

High risk patients, both males and females aged 18 to 35 years, were referred to the clinic from other hospital departments, including emergency.

Study phases and follow-up examinations

Following the baseline clinical examination the study timeline was divided into four phases. During the study phases, both caries risk and dental caries treatment were managed according to the CMS protocols (see appendix A). The protocols focus on (1) reducing dental plaque, (2) reducing dietary added sugar, (3) on the application of topical fluoride to demineralized tooth surfaces as diagnosed clinically, or via bitewing radiographs, and (4) monitoring via frequent recall and coaching sessions. The dentist's role is that of encouragement and motivation of patients to continue, and of monitoring (1) plaque control, (2) sugar reduction, (3) fluoride exposure, and (4) the status of at-risk surfaces when patients attend recall appointments, spaced according to patient risk.

Phase 1 – the control phase. The control phase included the initial treatment following the baseline examination. During this phase patients were also assessed regarding their readiness to change oral health behaviour, and efforts were made to encourage and motivate patients. Patients were advised that to *qualify* for permanent fillings in phase 4, they should demonstrate that they were able to maintain *low plaque scores* and *follow the home care instructions*.

Phase 2: the monitoring phase. During this phase patients were recalled every two weeks during the first three months for home care motivation and coaching in oral hygiene. The Gingival Index (GI) was recorded at each coaching session.

Phase 3: the 3-month – trial phase. Patients were not recalled during this phase. However, they were advised to follow the home care instructions in order to maintain their improved oral health status. At the end of this phase, they were recalled to commence phase 4.

Phase 4: the 6-month follow-up. Patients were recalled for clinical and radiographic re-evaluation, six months after the first visit. New bitewing radiographs were taken and the status of previous lesions was evaluated, as well as the identification of new lesions. Permanent fillings were placed according to the restoration protocol (see appendix B)

Baseline clinical examination

All patients referred to the clinic were subjected to a baseline examination, which included medical and dental history, diet history (24 hour diet questionnaire), and clinical assessments of oral hygiene status, dental caries status, and caries risk.

Medical and dental history

A medical and dental history questionnaire (Westmead Centre for Oral Health see appendix D) was completed.

Diet history

The frequency of between meals snacks and added sugar was assessed by using a 24 hour diet questionnaire (see appendix F).

Oral hygiene status

The level of plaque control obtained by the patients was assessed in terms of the Gingival Index (GI) (Löe, Silness, 1963) rather than the Plaque Index (PI) of Silness and Löe (1964), since it was found that that PI and GI scores are highly correlated and that, therefore, one can be used as a surrogate for the other. The advantage of using the GI is that it can less be manipulated by patients. For example, a patient who normally has poor plaque control might brush his teeth carefully prior to a dental appointment at which the oral hygiene status is to be recorded. This would lead to a low plaque score. However, since the associated gingival response is not immediate, the higher GI score would reflect the true oral hygiene status of the patient. According to the Gingival Index, tooth surfaces are scored as 0, 1, 2, or 3, respectively, in relation to gingival sites that demonstrate no gingival inflammation, gingival inflammation but no bleeding, bleeding on gentle probing, or spontaneous bleeding. This examination included the inspection of gingival sites along the buccal and the lingual surfaces of teeth 16, 11, 26, 36, 41, and 46 (12 sites altogether).

Dental caries status

Occlusal, buccal, and lingual surfaces - All exposed tooth surfaces were assessed at the baseline clinical examination. Special attention was given to record white spot lesions. Each non-restored surface was recorded as sound, or carious and non-cavitated or cavitated. Data was recorded on the clinical chart (see appendix E) in patient folders and later entered electronically for analysis.

Proximal surfaces - Bitewing radiographs were taken at the same appointment. The same skilled person took all bitewing radiographs at the X-ray Department. A "D" speed size 3 bitewing film was used. This film type requires 2/3 more exposure than standard films resulting in more image contrast. For each participant, a set of two to four bitewing radiographs was taken to include pre-molars and molars. All approximal surfaces, from the distal of the third molar to the mesial of the canine, were examined and scored for caries.

The following bitewing radiolucency grades were assigned in relation to proximal and occlusal surfaces:

0. No radiolucency evident.
1. A radiolucency is evident in the **outer half** of enamel.
2. A radiolucency extends into the **inner half** of enamel and may reach the DEJ.
3. A radiolucency extends **just** beyond the DEJ.
4. A radiolucency is evident in the **outer third** of dentine.
5. A radiolucency extends into the **inner two thirds** of dentine and may reach the pulp.
6. Filled
8. Overlap: this code was assigned if more than half of the enamel thickness was overlapped.
9. Missing: this code was assigned to a proximal surface of a tooth when that tooth was not completely included in the radiograph, that is, the distal or mesial surface that is not in the field of view is coded 9.

In cases where (1) the enamel cap was clearly defined and (2) where there was no evidence of enamel radiolucency, and yet dentine radiolucency was evident, the diagnosis was reached following clinical inspection. If, on clinical inspection, signs of caries could not be established, the surface was scored as zero.

Bitewing radiographs data reading - At baseline, one examiner (AS) made the diagnosis of radiolucencies of dental origin by using a viewer and a magnifying glass. For six participants, the same examiner and one other examiner, independently, using the same viewer and magnifying glass, carried out duplicate recordings.

Measurement reliability

Reliability is determined by calculating the Kappa statistic. This is a measure of degree of non-random agreement between examiners or measurements of the same categorical variable.

“... If measurements agree more often than expected by chance, kappa is positive; if concordance is complete $\text{kappa}=1$; if there is no agreement, $\text{kappa}=0$; if the measurements disagree more than expected by chance, kappa is negative.” (Last, 2001).

Values of Kappa below 0.40 may be taken to represent poor or only fair reliability, values between 0.41 and 0.60, moderate reliability, values between 0.61 and 0.80,

substantial reliability, and values between 0.81 and 1.00, almost perfect reliability (Landis, Koch, 1977). The respective intra-examiner and the inter-examiner kappa values were 0.987 and 0.971. In relation to lesions where examiners gave different diagnoses, mutual agreement was reached following consultation.

At the six month follow-up, new bitewing radiographs were taken and read, without reference to the baseline data, by AS.

Assessment of caries risk

Each patient referred to the clinic was considered as “a new patient”. According to the Caries Management System protocols, there are three caries risk categories: high, medium, and low risk. High risk patients are those who present with: (1) untreated frank cavities, and/or (2) extensive and friable white spots lesions, and/ or (3) bitewing radiolucencies greater than grade 4 or 5. Patients presenting with no frank cavitation, but having sticky pit/fissures, and/or bitewing radiolucencies not greater than grade 4, are considered as medium risk patients. Low risk patients are those presenting with no signs of caries, but they may have bitewing radiolucencies not greater than 3.

Assessment of patient readiness for oral health behaviour change

During the first oral hygiene coaching session, patients were asked informally if they would be willing to start to brush daily, and continue to do so during the audit period. Patients who indicated willingness were classified as ready to change (RTC) their oral health behaviour. The others, who were not willing or not sure, were classified as being not ready to change (NRTC) their oral health behaviour.

Treatment

Dental caries was managed according to a set of protocols referred to as the Caries Management System (see appendix A). Following a case presentation, patients received oral health education and motivation, individual oral hygiene instruction, home care instructions, lesion management as necessary including topical fluoride application and temporary fillings, and recall monitoring.

Case presentation including patient education and motivation

At the second appointment, patients received a detailed case presentation. Each received an educational pamphlet about dental caries, and details regarding their caries status were recorded on it. (see appendix I). This pamphlet contained essential information on tooth decay. Most importantly, participants were informed that tooth decay can be stopped, prevented and reversed. Bitewing radiograph details were also recorded on this pamphlet, to educate about the number and extent of their carious lesions and respective management.

Oral hygiene instruction

In some cases, oral hygiene instruction commenced at the baseline clinical examination and not at the second appointment. While the patient was seated on the dental chair, the dentist demonstrated plaque around gingival margins, and patient observed this via a hand mirror. Oral hygiene instruction and further oral hygiene coaching every two weeks was conducted in a special room designed for that purpose. During the oral hygiene coaching procedure, patients demonstrated how they usually brushed (if they did) in front of a wall mirror, while the dentist marked on the “Where do I brush” pamphlet (see appendix J) the areas that they were missing. After that, both dentist and patient reviewed the tooth brushing performance, and a brushing demonstration was conducted using dental models. Next, the patient went back to the wall mirror to practice the new movements. This process, which took up to 15 minutes, was focused on each patient’s individual needs.

Home care

Home care included tooth brushing with Colgate Neutrafluor 5000 ppm ® toothpaste twice daily, and tooth brushing with Chlorofluor gel® (0.2%chlorhexidine gluconate, 15 ppm of

NaF), before bedtime, daily. Patients received one tube of the mentioned toothpaste at the beginning of the study, and chlorhexidine gel was provided, as they needed.

Lesion management

Non-cavitated buccal, lingual and proximal tooth surfaces

Non-cavitated buccal, lingual, and proximal tooth surfaces graded 1, 2, and 3 received topical fluoride applications of fluoride varnish (Duraphat ®) every two weeks during phase 2.

Cavitated occlusal, buccal, lingual, and proximal tooth surfaces

Accessible surfaces, able to be cleaned – Accessible tooth surfaces were treated during phase 1 as for the non-cavitated surfaces, as described above. In some cases, associated with undermined enamel, softened dentine was removed as described below for the non-accessible surfaces, and the undermined area was temporarily filled with GIC. The remainder of the cavity was treated non-invasively.

Non-accessible surfaces – Occlusal and proximal surfaces presenting radiolucency grades of 4 and/or 5, were temporarily filled with GIC (Fuji 7 ®) during phase 1. Access was made with a round bur, following which softened dentine was removed using a hand excavator until reaching the “leathery” dentine. Dentine conditioner was applied and a temporary restoration was placed. This procedure aimed to: (1) prepare the oral environment for caries arrest and bacterial infection reduction, (2) facilitate tooth brushing and (3) to prevent food impaction in open cavities.

Monitoring

The clinical monitoring included a review of oral hygiene at each coaching session during phase 2 and the recording of Gingival Index (GI) scores. GI scores were recorded in a form called “the plaque report form” (see appendix G) every two weeks, and later entered electronically for analysis. The bitewing radiograph monitoring was conducted at baseline and at the 6-month follow-up. Data was recorded on the bitewing radiographic assessment form (see appendix H), and later was entered electronically for analysis. Data for surfaces recorded as filled, overlapped, and missing were not included in the analysis of the radiographic data (see Appendix K for digital images of bitewing radiographs).

Data analysis

Data analysis included the assessment of changes from baseline till the 6-month follow-up of (1) gingival index scores, (2) bitewings radiographs scores, and (3) caries clinical findings. Differences in proportions were tested using the Chi-squared and Fisher's Exact Test. The data analysis was conducted using both SPSS 10.0 and Epi info 3.2.2 software.

RESULTS

The cohort of patients

A total number of 45 patients, mean age of 22.28 years (SD 3.02), were referred to the CMC clinic during 2005. Table 2 illustrates patient characteristics at the baseline examination including details of age, sex, medical history, social history, and tooth brushing frequency.

Dropouts

There were 17 dropouts from June until November, and at the time of writing, 28 were currently being treated at the clinic. Among the dropouts, none dropped out before their third visit (see Table 3). Twenty of these 28 patients were followed until the end of December 2005. Two patients were classified as low risk and 18 patients were classified as being at high risk of dental caries.

Summary of baseline and 6-month follow-up data for caries experience and gingival status

The results for caries experience and gingival status (GI) at the baseline examination and the 6-month follow-up in relation to the 20 patients are presented in Table 4.

At baseline, the mean DMFT was 18.0, and included 10.0 D teeth and four each of M and F teeth. Following treatment, the decayed component decreased to 0.4 and the missing and filled components increased.

The total numbers of site-specific non-cavitated carious surfaces ranged from 16 to 101 at baseline, and following remineralizing treatment with fluoride varnish the numbers of carious surfaces were substantially reduced.

At baseline, the mean numbers of site-specific cavitated lesions (soft-based) ranged from 39 to 92. The reductions shown after 6-months (total numbers now ranging from 1 to 9) are summary values for treatment by fluoride varnish alone or by excavation and dressing with GIC. Since none of the GIC restorations were associated with recurrent

caries, the lesions that persisted were those that did not respond to the remineralizing fluoride varnish. Further details of the treatment outcomes in relation to the treatment of the carious surfaces are given in Table 5, and in Figures 1 and 2.

In relation to the distribution of proximal surface bitewing grades (Table 4), half of the grade 1 surfaces (outer enamel) had regressed following treatment; 62 were observed at baseline whereas only 34 were observed at follow-up. Modest reductions were observed in relation to grade 2 and 3 radiolucencies; on the other hand, grade 4 and 5 radiolucencies were almost eliminated due to restorations or extractions. Further details relating to changes in bitewing radiolucency are given in Table 6.

Finally (in Table 4), the summaries of the GI scores indicate substantial improvement between baseline and follow-up; for example, only 27% of the 12 sites per patient that were scored zero at baseline whereas this increased to 68% by the time of the 6-month follow-up. Further details regarding the distribution of the GI scores are given in Figures 3, 4, and 5.

Changes observed in oral health behaviour

Tooth brushing - At baseline it was verified that the majority of patients attending the clinic did not have a well-established tooth brushing habit. During phases 1 and 2, patients responded positively to oral hygiene coaching sessions and the majority of them started to brush at least once daily (usually night time).

Use of fluoride toothpaste and chlorhexidine gel - All patients continued to use Colgate Neutrafluor 5000 toothpaste ® and Chlorofluor gel ® during the whole period of the audit.

Diet change - It was observed, informally, after three months (at the end of Phases 1 and 2), that patients were unable to change their diets. For instance, it was reported by many that they continued to have up to three teaspoons of sugar in coffee or tea, or to keep drinking soft drinks during the day (even bringing soft drinks with them to their dental appointments). The only positive outcome was that three out of the 20 patients adhered to advice to chew gum after meals.

Table 2: Patient characteristics at baseline:

ID	AGE (years)	SEX*	Engllish speaking	Medical history	Dependent children	Social history	Tooth brushing frequency
1	18	M	Yes	Mentally disabled			—
2	29	F	Yes		5 children		Once daily
3	23	F	Yes	Smoker			—
4	19	F	Yes	Smoker			—
5	21	F	Yes		1 child	Domestic violence	—
6	19	M	Yes				—
7	22	M	Yes				—
8	25	M	Yes	Smoker			—
9	32	F	Yes	Previous radiotherapy	3 children	Domestic violence	—
10	25	M	Yes	Drug addiction			—
11	23	F	Yes		1 child		Twice daily
12	20	M	Yes	Ex smoker			Twice daily
13	23	F	Yes	Smoker	3 children	Domestic violence	—
14	23	M	Yes	Drug addiction			—
15	24	M	Yes				Once daily
16	25	M	Yes				Once daily
17	24	F	Yes	Drug addiction			—
18	18	M	Yes				—
19	23	F	Yes				—
20	23	M	Yes				Once daily
21	20	F	Yes				Once daily
22	20	M	Yes				Once daily
23	20	F	Yes				Once daily
24	21	M	Yes	Smoker			—
25	22	M	Yes	Mentally disabled			—
26	24	F	NESB**		2 children		—
27	22	F	Yes	Pregnant and Smoker			—
28	24	F	Yes		3 children		—
29	29	F	Yes		2 children		Once daily
30	25	M	Yes				—
31	25	M	Yes	Smoker			—
32	22	M	Yes	Mentally disabled			—
33	22	F	Yes		1 child		—
34	22	M	Yes	Smoker			Once daily
35	20	M	Yes				—
36	19	M	Yes				Once daily
37	21	F	Yes				Once daily
38	19	F	Yes				Twice daily
39	26	F	Yes		1 child		Once daily
40	18	M	Yes				Once daily
41	20	F	Yes				Once daily
42	23	F	Yes		1 child		—
43	20	M	Yes				—
44	21	M	Yes				Once daily
45	19	F	Yes				Once daily

* M=male; F=female

** NESB=non English speaking background

Table 3: Record of patient follow-up.

ID	First visit	Baseline readiness to change*	Dropout** period	Dropout*** reason	Currently in the clinic
1	April	0			X
2	April	0			X
3	April	0	Phase 2-3	a	
4	April	0			X
5	April	1			X
6	April	0			X
7	April	0	Phase 2-3	b	
8	April	0			X
9	May	1			X
10	May	0	Phase 2-3	c	
11	May	1			X
12	May	0			X
13	May	0			X
14	May	0			X
15	May	0	Phase 2-3	a	
16	May	0	Phase 2-3	a	
17	June	1			X
18	June	0			X
19	June	0	Phase 3-4	a	
20	June	1			X
21	June	0			X
22	June	1			X
23	June	0	Phase 2-3	a	
24	June	1			X
25	June	1	Phase 3-4	c	
26	June	0	phase 2-3	a	
27	June	1	Phase 3-4	c	
28	July	0			X
29	July	1			X
30	July	0			X
31	August	0	phase 3-4	a	
32	August	0			X
33	August	1			X
34	September	1			X
35	September	0	Phase 2-3	a	
36	September	0	Phase 2-3	a	
37	September	1			X
38	September	0			X
39	September	1			X
40	September	0		a	
41	October	1			X
42	October	1			X
43	October	0	Phase 2-3	a	
44	October	0	Phase 2-3	c	
45	October	0	Phase 2-3	a	
Total				17	28

shaded area refers to the 20 patients followed for 6 months

* 0=not ready to change, 1=ready to change

** No patient dropped out till after 3rd appointment.

*** a= Reason not identified, b= Unable to attend due to work commitments, c= Unable to attend due to serious health condition (drug addiction, general health compromised, or pregnancy complications)

Table 4: Caries experience* and gingival status (Gingival Index = GI) at baseline and after 6 months follow-up in 20 patients:

Baseline	Caries tooth surface**										Cavitated tooth surface***					Proximal surface bitewing grade					Gingival Index****					
	D	M	F	DMFT	Occ			Ling			Bucc			Occ	Ling	Bucc	Prox	0	1	2	3	4	5	GI 0	GI 1	GI 2
Total	198	79	78	355	35	22	101	16	39	40	84	92	689	62	22	19	19	28	Total sites	70	80	114				
Mean	10.0	3.9	3.9	18.0	1.7	1.0	5.0	0.8	1.9	2.0	4.2	4.6	34.5	2.6	1.0	1.0	0.6	1.4	% sites	27	30	43				
SD	7.5	3.4	3.4	9.2	3.2	2.8	5.8	2.0	1.6	1.6	3.9	3.6	12.0	3.1	1.1	1.1	0.8	2.8								

After 6 months	Caries tooth surface*										Cavitated tooth surface**					Proximal surface bitewing grade					Gingival Index****					
	D	M	F	DMFT	Occ			Ling			Bucc			Occ	Ling	Bucc	Prox	0	1	2	3	4	5	GI 0	GI 1	GI 2
Total	7	159	215	381	3	8	29	0	1	0	9	7	686	34	17	12	3	2	16	Total sites	179	24	60			
Mean	0.4	8.0	11.0	19.0	0.2	0.4	1.5	0.0	0.1	0.0	0.5	0.4	34.3	1.5	0.8	0.5	0.1	0.1	0.6	% sites	68	9	23			
SD	0.6	3.5	5.2	9.0	0.6	2.0	2.7	0.0	0.2	0.0	1.3	1.3	13.5	1.9	1.1	0.8	0.2	0.3	2							

* The D component of the DMFT Index refers to lesions coded as D3, that is, cavity extending into dentine
** Surface classified as either D1 (white spot lesions) or D2 (cavitated enamel lesion that does not extend into dentine)
*** D3 lesions
**** Assessed at 12 sites per person

Details of caries experience recorded at the clinical examination at the baseline and after six months

Table 5 shows the status of non-proximal surfaces as determined clinically at baseline and after six months of treatment in 20 patients. The right hand column in Table 5 shows the baseline totals in relation to each diagnosis. The shaded diagonal indicates the number and percentage of the baseline totals that remained unchanged during the six months period. Numbers shown above the diagonal indicate treatment failures, and numbers below indicate successes.

At the baseline examination, 2219 tooth surfaces were sound, and 99% of those tooth surfaces remained sound after six months. Thirteen sound surfaces, shown as extracted, belonged to teeth that were extracted due to advanced caries, or belonged to impacted third molars. In addition, 142 tooth surfaces presented opaque white spots at the baseline examination, and 70% of these became arrested and appeared as shiny white spots after six months. At baseline, there were 228 soft-based cavities of which 137 were temporarily restored with GIC (Fuji7®). None of the GIC restorations presented with recurrent caries after six months. Twenty-four other soft-based cavities became hard and black after six months following the fluoride varnish treatment. A total number of 80 surfaces (16 teeth) were extracted due to advanced caries. Nine opaque white spots, one sealed surface, and two sound surfaces at baseline progressed to soft-based cavities after six months.

The within individual distribution of clinical outcomes in relation to the opaque white spots followed for six months is given in Figure 1. This indicates that for nine patients, all opaque white spots were remineralized successfully, and that for five patients, all or some white spots deteriorated. The response to the treatment of the soft-based cavities is shown in Figure 2 which gives details of the within individual distributions. As noted in Table 5, none of the cavities treated with GIC became involved with secondary caries. For cavities treatment with fluoride varnish, the response was mixed. In six treated patients, some of or the entire number of cavity bases became hard and black following fluoride varnish treatment, while in seven patients there was no response to the varnish treatment in some or all the lesions.

Table 5: The status of non-proximal surfaces as determined clinically at baseline and after 6 months of treatment in 20 patients.

Surface status after 6 months of treatment											
Surface status at baseline	GIC and sound (Fuji7 ®)										Baseline totals
	0	1	2	3	4	5	6	Extracted			
Sound	0	2197 (99%)			7		2	13*	2219		
Sealed	1	4 (80%)					1		5		
Filled and sound	2		143 (97%)				5		148		
Shiny white spot	3			0 (0%)					0		
Opaque white spot	4			100	33 (23%)		9		142		
Hard-based cavity	5					0 (0%)			0		
Soft-based cavity	6					24	0 (0%)	67	228		
Totals after 6 months		2197	4	143	100	40	17	137	80	2742	

Number and (%) of surfaces that remained unchanged from baseline

* Sound surface belonging to a tooth that was extracted due to advanced caries or belonging to an impacted 3rd molar

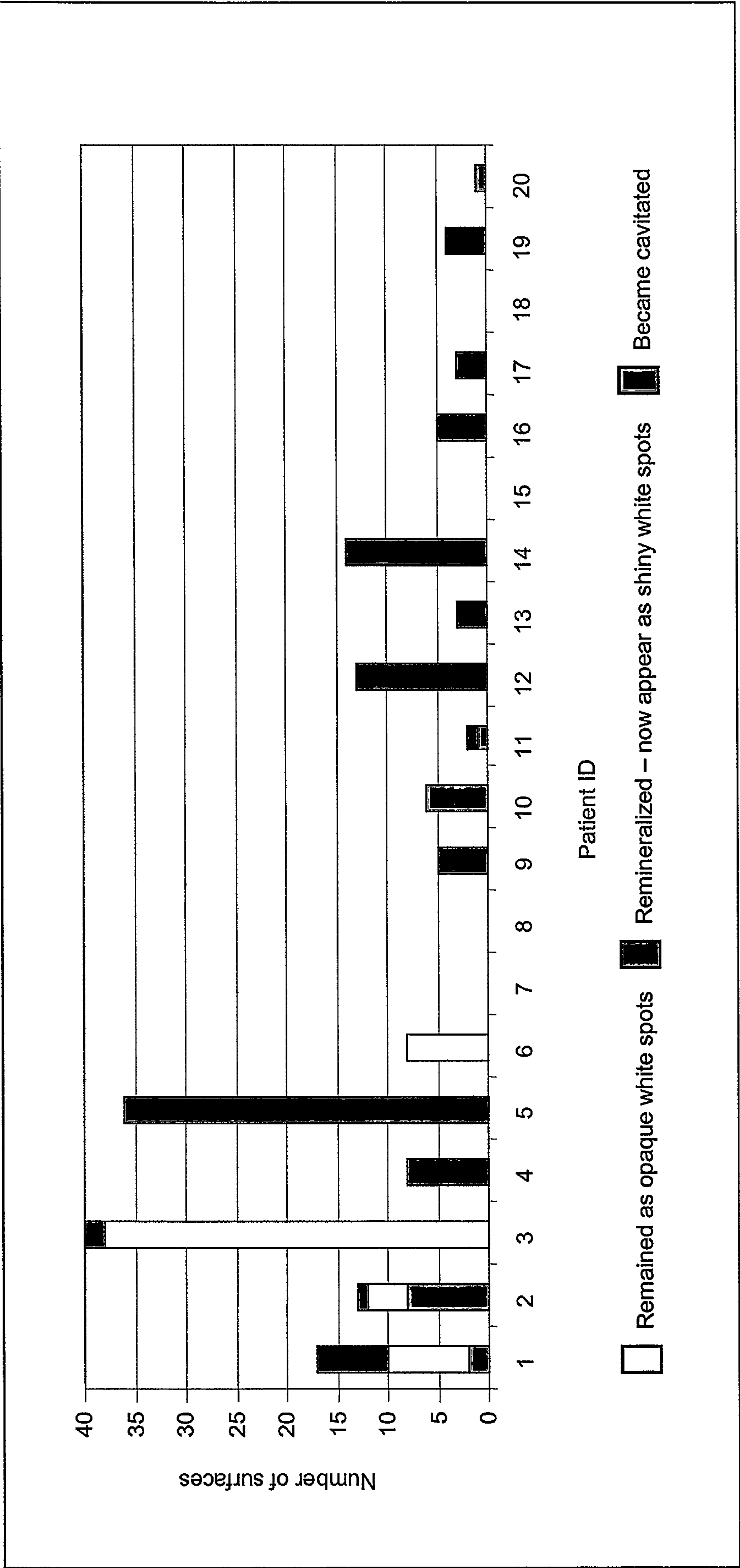


Figure 1: Distribution within 20 patients of opaque white spots after 6 months of treatment with F varnish.

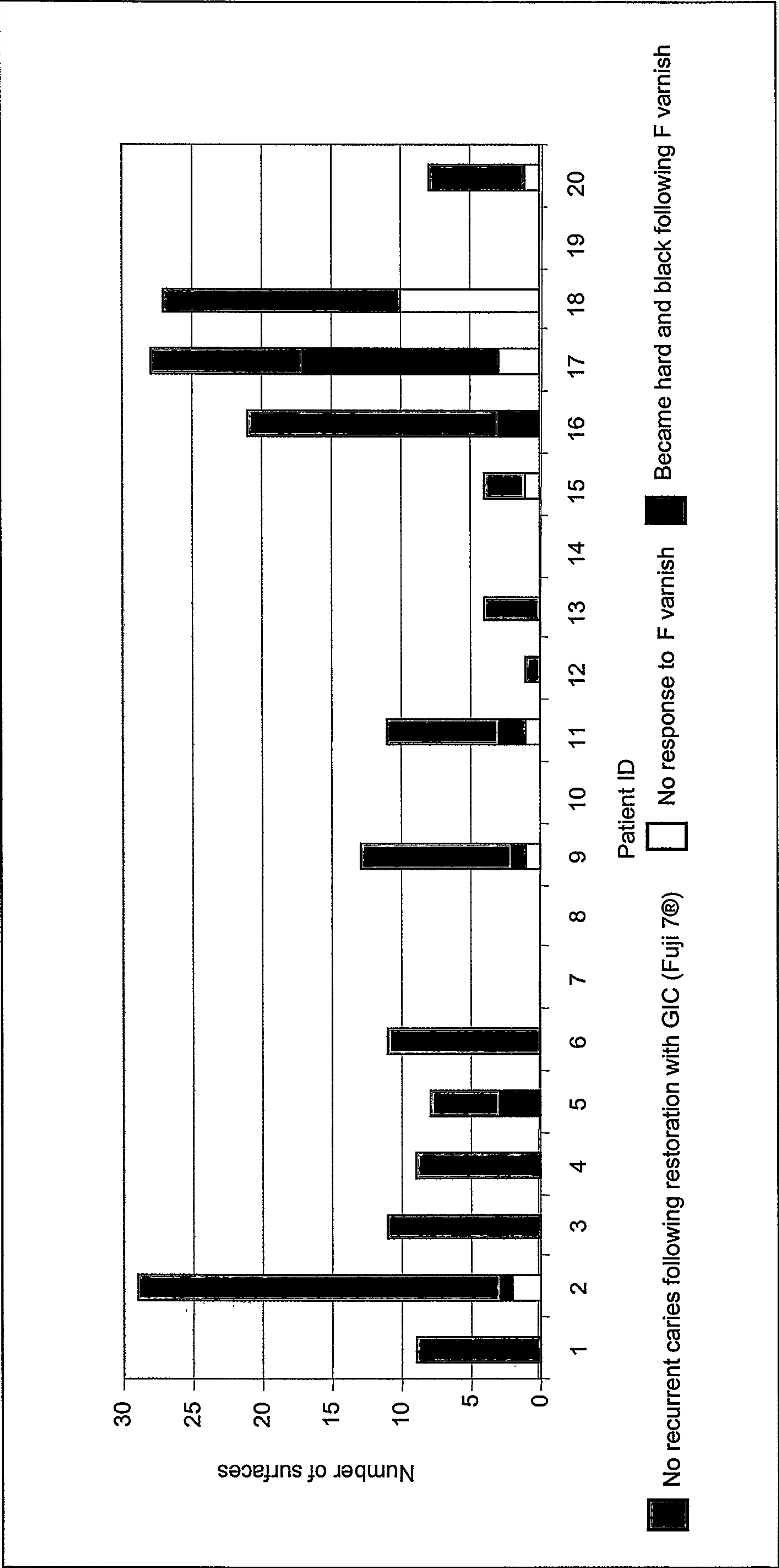


Figure 2: Distribution within 20 patients of soft-based cavities treated with either GIC (Fuji 7®) or F varnish after 6 months.

Details of the bitewing radiographs at baseline and after six months

Table 6 presents the status of proximal surfaces as determined from bitewing radiographs at baseline and after six months of treatment in 20 patients. As for Table 5, the right hand column of this Table shows the baseline totals in relation to each diagnosis. Similarly, the shaded diagonal indicates the number and percentage of the baseline totals that remained unchanged during the six-month period.

There were three new occlusal lesions following baseline, two of which had progressed to dentine. At the baseline examination, 683 proximal surfaces were sound, and 95% of this remained sound after six months. Nineteen sound surfaces, at baseline, belonged to teeth that were extracted due to advanced caries or belonging to impacted 3rd molars, were shown as extracted at follow-up. About half of the grade 1 and 2 radiolucencies observed at baseline were observed to have regressed after six months, and only two surfaces scored grade 1 had deteriorated by six months, and another four were listed as missing due to surfaces involved being outside of the bitewing field of view. Only two 'just into dentine' lesions (grade 3) remineralized and were scored as grade 2 at follow-up. Most of the grade 4 radiolucencies observed at baseline were associated with lesions that were restored, and the baseline grade 5 radiolucencies were associated with teeth that were either restored or extracted.

Table 6: The status of proximal surfaces as determined from bitewing radiographs at baseline and after 6 months of treatment in 20 patients.

Surface status at baseline	Surface status after 6 months of treatment										Baseline totals
	0	1	2	3	4	5	Filled	Extracted	Overlap	Missing*	
Sound	657 (95%)		1	2				19**	4		683
Outer 1/2 enamel	29	25 (40%)	2						2	4	62
Inner 1/2 enamel		9	12 (55%)				1				22
Just into dentine			2	10 (53%)			4		3		19
Outer 1/3 dentine					3 (14%)		18				21
Inner 2/3 dentine						2 (6%)	10	20			32
Totals after 6 months	686	34	17	12	3	2	33	39	9	4	839

Number and (%) of surfaces that remained unchanged from baseline

* Surface not showing in bitewing field of view

** Sound surface belonging to a tooth that was extracted due to advanced caries or belonging to an impacted 3rd molar

The gingival status at baseline and after three and six months

Figure 3 illustrates the overall percent distribution of GI scores. None of the sites presented GI scores of 3 at baseline or at the 6-month follow-up. At the baseline examination, 70 sites had GI scores of zero, which represented 27% of the 240 sites examined. At the 6-month follow-up, there was an increase of 41% in the number of sites presenting Gingival Index scores of zero. The percent of sites having Gingival Index scores of 1 decreased from 30% at baseline to 9% after six months. There was a reduction of 20% from baseline of sites presenting GI scores of 2; these changes were highly significant ($\chi^2=17$, $p<0.001$).

Details of gingival status at the baseline examination, and after three and six months

Figure 4 illustrates the percent distribution of Gingival Index (GI) scores, based on 12 sites per patient, at baseline and after three months for 32 patients ($\chi^2=103$, $p<0.001$) and after six months for 20 patients ($\chi^2=17$, $p<0.001$). The missing data for 12 patients after six months relates to four dropouts and eight patients who have been in the clinic for less than six months. In comparison to the baseline gingival status, it was observed that 25 patients improved their gingival status by showing more sites presenting GI =0 after three months. However, it was also noted that patients 1, 9, 10, and 17 did not present much improvement after three months. After six months, it was observed that 13 patients continued to have a few sites showing bleeding on gentle probing (GI=2).

Patient readiness for oral health behaviour change at baseline in relation to the gingival status improvement after 6 months

At baseline, eight patients were classified as ready to change (RTC) their oral health behaviour, and 12 patients as being not ready to change (NRTC) as shown in Table 7. At baseline, there was no statistically significant difference between patients regarding their GI scores ($\chi^2=19.81$, $p=0.70$). After six months, RTC patients had an increased number of sites scored GI=0, but the difference was not significant ($p=0.10$). On the other hand, these patients had significantly fewer sites scored GI=2 compared to NRTC patients ($p=0.01$) (Table 8). Compared with the NRTC patients, RTC patients were more than twice as likely

to have fewer sites scored two ($RR=2.43$). Figure 5 presents a graphic illustration of individual GI scores at baseline and at the 6-month follow-up by readiness for oral health behaviour change.

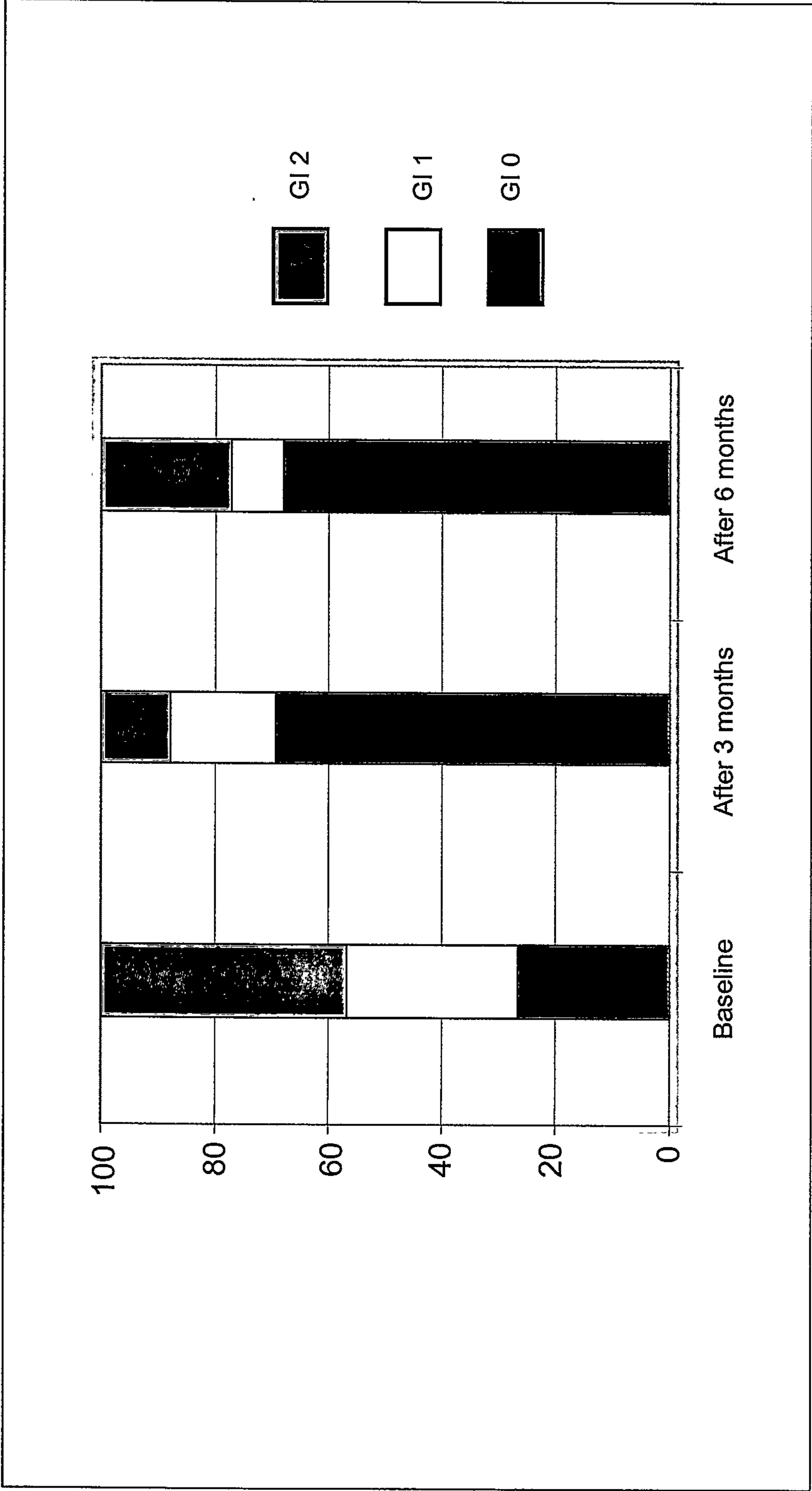


Figure 3: Percent distribution of Gingival Index (GI) scores in relation to 240 sites (12 sites per patient) at baseline and after 3 and 6 months for 20 patients.

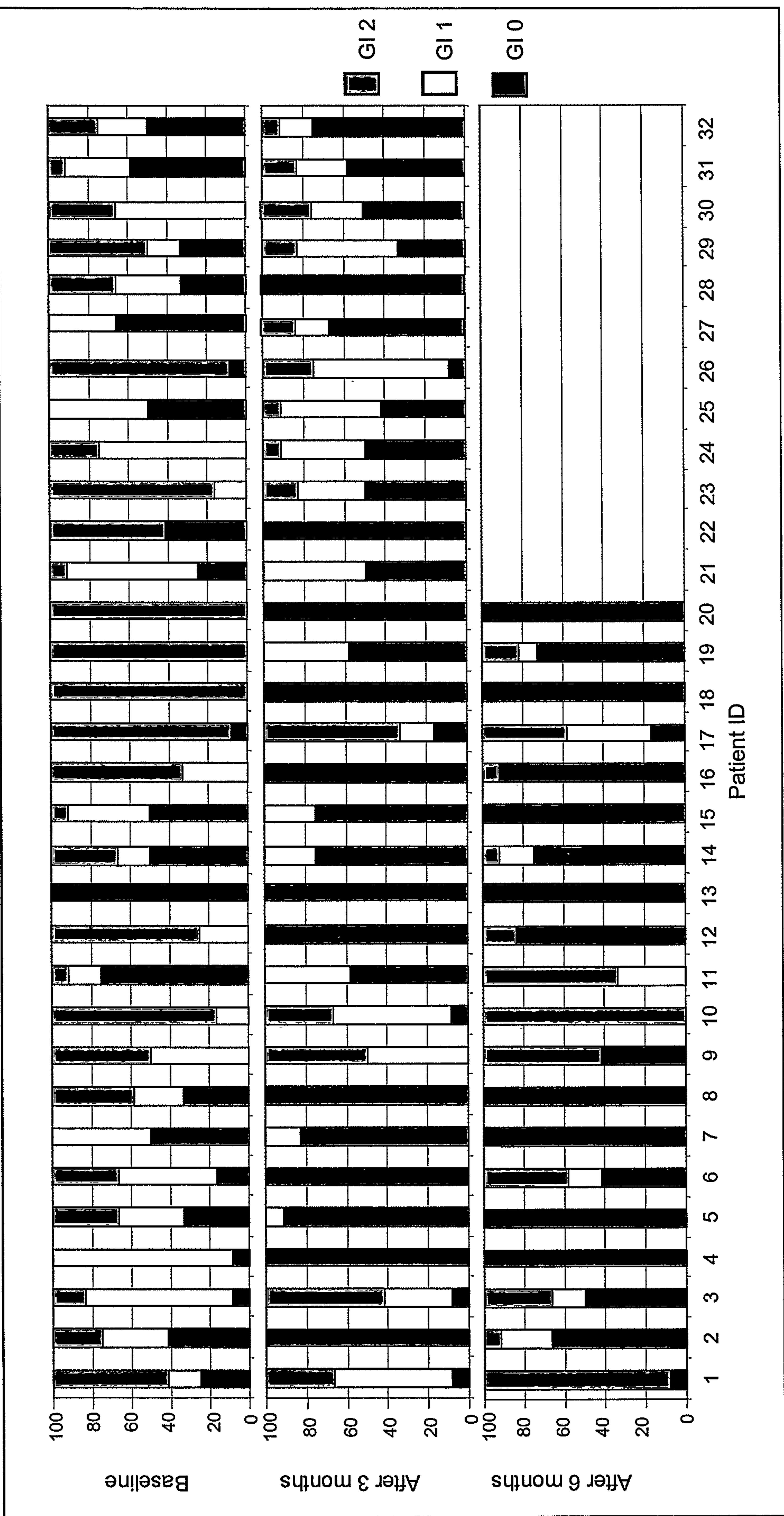


Figure 4: Percent distribution of Gingival Index (GI) scores, based on 12 sites per patient, at baseline and after 3 months for 32 patients and after 6 months for 20 patients.

Table 7: Patient readiness to change oral health behaviour at baseline by Gingival Index (GI) score at baseline and after 6 months:

ID	Baseline* readiness to change	Frequency of GI scores at baseline			Frequency GI scores after 6 months		
		GI 0	GI 1	GI 2	GI 0	GI 1	GI 2
1	0	3	2	7	1	0	11
2	0	5	4	3	8	3	1
3	0	1	9	2	6	2	4
4	1	1	11	0	12	0	0
5	0	4	4	4	12	0	0
6	0	2	6	4	5	2	5
7	1	6	6	0	12	0	0
8	1	4	3	5	12	0	0
9	0	0	6	6	5	0	7
10	0	0	2	10	0	0	12
11	0	9	2	1	0	4	8
12	1	0	3	9	10	0	2
13	1	12	0	0	12	0	0
14	1	6	2	4	9	2	1
15	0	6	5	1	12	0	0
16	1	0	4	8	11	0	1
17	0	1	0	11	2	5	5
18	0	0	0	12	12	0	0
19	0	0	0	12	8	1	2
20	1	0	0	12	12	0	0
21	0	4	6	2			
22	1	5	0	7			
23	0	0	2	10			
24	1	0	9	3			
25	1	6	6	0			
26	0	1	0	11			
27	0	8	4	0			
28	1	4	4	4			
29	1	4	2	6			
30	0	0	0	12			
31	0	0	8	4			
32	0	6	3	3			

* 0= not ready to change; 1= ready to change
shaded area represents the 20 patients followed for 6 months.

Table 8: Distribution of GI scores of 20 patients after 6 months in relation to patient baseline readiness to change oral health behaviour.

Patients presenting with fewer GI=2 sites after six months than at baseline				
		Yes	No	
Baseline readiness to change behaviour	RTC*	a 8	b 0	8
	NRTC**	c 5	d 7	12
		13	7	20
RR =(a/a + b) / (c/c + d) = 2.43 (p = 0.01)				

*RTC=ready to change
**NRTC=not ready to change

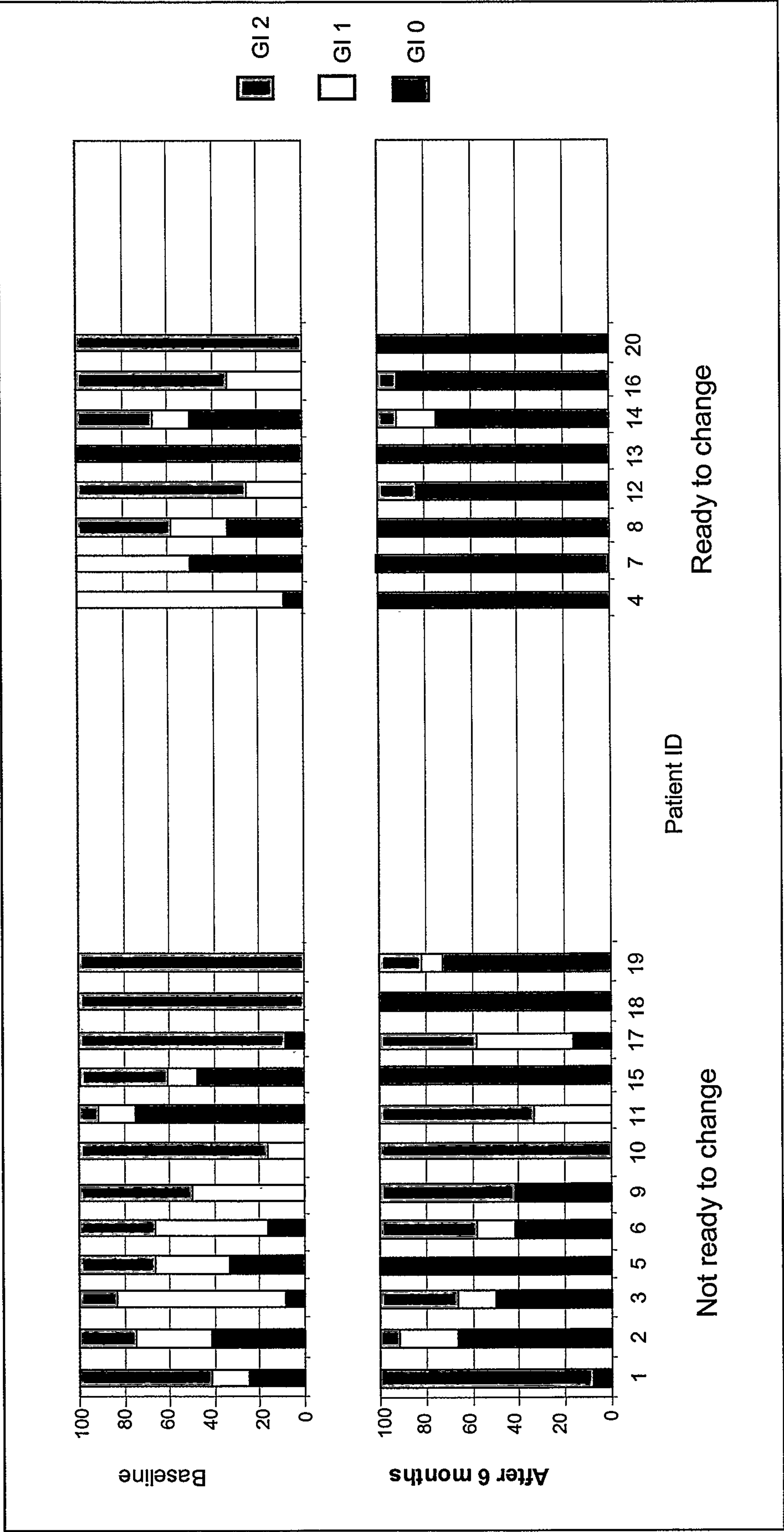


Figure 5: Percent distribution of Gingival Index (GI) scores, based on 12 sites per patient, at baseline and after 6 months for 20 patients, in relation to baseline readiness to change oral health behaviour ($\chi^2=17$, $p<0.001$).

DISCUSSION

The present study demonstrated that a mainly non-invasive caries management protocol, which combined frequent professional applications of topical fluoride, intensive coaching in oral hygiene maintenance, special home care, and intensive monitoring, was able to reduce caries incidence and progression in a group of high risk patients. The RTC patients were more likely to improve their gingival status and maintain it. On the other hand, some NRTC patients can become motivated, most likely because they were supported and encouraged to pursue this goal. According to Sandell et al. (1994), patients come into dental treatment with pre-established dispositions: positive, optimistic, and thankful or negative, fearful, and angry. Furthermore, the authors asserted that patient willingness to comply with the proposed treatment is empowered by the dentist's approach. The ... "dentists' involvement if strong and if positive or negative enough may decisively facilitates or inhibits patient's compliance". In this sample of patients, the readiness to change home care behaviour and the researcher's awareness and understanding of each particular patient situation were probable predictors for success. The oral health improvement was probably due to the fact that patients were encouraged to take responsibility for their home care. This view is supported in a review of interventions to motivate people to cut down on alcohol consumption (Joffe, 2000). It was concluded that there are six elements that have an effective intervention impact, and among them is the person taking responsibility for changing.

Patient recruitment

Patient recruitment in this study was not a straightforward task. The main difficulty was out-of-date contact details, such as correct phone number and residential address. As each patient is responsible for updating contact details by informing the hospital, and since these patients may have been on the waiting list for two years, there was no way that the researcher could successfully contact some patients who were referred to the CMC.

Patient attendance

The majority of patients who discontinued attending the clinic between phases 2 and 3 were not ready to change their oral health behaviour. Apart from some patients, whose part-time work commitments no longer allowed them to continuing attending the clinic and other patients who were no longer able to attend the clinic due to serious health conditions, it is unknown why 12 other patients decided to discontinue the treatment. According to a review on behavioural science and dental practice, factors affecting dental visits can be described as illness and health-related factors, socio-demographic factors, service-related factors, attitude or subjective factors, previously missed or cancelled appointment, unemployment, negative views of dentists, and high caries experience (Schou, 2000).

Patient's attendance was affected by transport availability; day of the week that the clinic is held, and school holidays in cases where patients had children. It is suggested that if the clinic could be held on at least two days per week, patients would be able to decide which day is more convenient, and their attendance rate might be higher. In addition, a system to confirm appointments, at least two days prior to the appointment would be ideal. If feasible, this system could save money and prevent waste of dentist time in the clinic.

Shortage of preventive materials

There were many obstacles that researchers had to overcome, such as the lack of certain preventive materials (GIC GC Fuji7®, Colgate Neutrafluor 5000 toothpaste ®) that were consumed weekly in the clinic or were given to patients for home care. Fortunately, the manufacturer (GC Asia) provided GIC during the period of the study, and when needed patients purchased the high concentrated fluoride toothpaste, although the first tube of toothpaste was provided by the clinic.

Process of care

Monitoring frequency

The monitoring process, which was carried out every two weeks, improved patient attendance and compliance with home care. Frequent monitoring is essential to motivate

these high risk patients. This finding is in accordance with other preventive programs involving schoolchildren, which were successful in preventing dental caries and improving gingival status (Axelsson et al., 1977). Other studies have involved adults who were recalled once a month and these were also effective in reducing caries incidence and gingival inflammation (Axelsson et al., 1991; Axelsson et al., 1994; De Paola, 1993).

Oral hygiene instruction

The oral hygiene training and coaching process, conducted every two weeks, was a continuing learning process for both patients and researcher. Patients reacted in different ways in relation to creating a daily brushing habit (brush daily) that the majority did not previously have. The researcher had to be very flexible and friendly in these circumstances, and together with each patient, overcome difficulties. By individualizing the oral hygiene coaching and giving special attention to the difficulties that each patient identified, the researcher was able to reach patient's feelings. For the majority of them, it was the first time that someone had taken an interest to spend 15 minutes with them, and to encourage them to make a change, and persist with it. Indeed, at the end of the study patients were very happy with their improvement and grateful for all effort done during the coaching sessions. The individualized frequent coaching may be the most important factor regarding patient's motivation and encouragement, which is in accordance with findings reported by Axelsson et al. (1991).

Care outcomes

The hypothesis, that the oral health and oral status of patients attending the CMC will not continue to deteriorate, as does that of many patients attending the General Practice Clinic at the WCOH which has, as its focus, the restoration of dental fitness through restorative (including exodontia where necessary) and prosthodontics care, was confirmed in relation to the effectiveness of the non-invasive management system, at least in relation to patients attending the CMC within the scope of this short-term review. This audit did not involve a cost-evaluation. It was claimed by Axelsson and Lindhe (1981), that the implementation of a dental care program, significantly improved oral health; it increased time and effort dedicated to preventive care, while the need for restorative treatment decreased.

DMFT and caries experience

At baseline the mean DMFT of 18.0 indicated that the young adult patients had a poor oral health status, while the mean number of decayed (D) teeth of 10.0 indicated that a serious oral health problem had developed over a number of years. This observed level of caries experience is much greater than found in the general population. In 2001, the DMFT scores for adult Australians aged 18-24 and 25-34 years were 7.8 and 13.3, respectively (Spencer, 2004). Further, the D components (untreated decay) in the same age groups were, respectively, 4.6 and 4.1.

However, after six months of a combination of non-invasive treatment, limited invasive care, and daily home care, a reduction of 95% in the mean number of decayed teeth compared to baseline was achieved. As a consequence, the mean numbers of missing and filled teeth increased by 100% and almost 200%, respectively.

The shift in the focus of care in this study towards the control of the causative factors of tooth decay, and the enhancement of natural repair resulted in: (a) prevention of new lesions in 14 out of 20 patients, (b) arrest of 70% of opaque white spots to shiny white spots, (c) arrest of 11% of soft-based cavities and their conversion to hard-based cavities, (d) the prevention of recurrent caries around temporarily filled tooth surfaces. These findings compare favourably with findings in relation to other high caries risk programs as the results reported by Katz (1982), Johansen (1987), and De Paola (1993). These authors were able to achieve caries incidence levels of close to zero and the remineralization of almost all radiation and root caries lesions.

In relation to non-cavitated proximal surfaces, the caries management approach implemented was efficient in prevention of new lesions in 95% of the cases; about half of enamel lesions were arrested. The successful prevention of new lesions in most of the patients was in accord with the study objective of reducing caries incidence to close to zero. These findings correspond to results obtained by Klimek et al. (1985); the authors reported a caries reduction of 46% on approximal surfaces following a preventive program.

Gingival status

The gingival status improvement, which in this study was used as the surrogate for improved oral hygiene, was most probably due to the frequent monitoring and individualized tooth brushing coaching and motivation, every two weeks for these high risk patients. Patients did realize that they were able to change, and it was observed that the gingival status improvement obtained after three months was maintained at the 6-month

follow-up. Axelsson et al. (1991) and Axelsson et al. (1994) concluded that patients who are exposed to prolonged monitoring eventually develop a sense of responsibility for their home care.

A factor that might have influenced patients to continue home care was the promise to replace the temporary pink GIC restorations for permanent tooth coloured restorations, provided that they presented with an improved GI. However, many patients volunteered the information that not having sensitive gums and being able to smile again was the key factors for them to maintain their motivation to continue home care.

Patient compliance

It was noted that oral hygiene improvement depends mostly upon each patient's life condition. Patients' socio-economic circumstances, which affect oral health status such as poor diet, zero tooth brushing frequency, and lack of visits to the dentist, were evident. For instance, among this group of high risk patients there were cases of: (a) women suffering from domestic violence, (b) patients with previous history of radiation (oral cancer), drug addiction, and mental disability, (c) mothers with up to 5 children, and (d) patients that had never brushed their teeth before and/or even did not know how to hold the toothbrush properly. A review on the relevance of behavioural sciences in dental practice confirmed that among all factors influencing patients' oral health, the most important is the situation the patient is in, including socio-economic situation, stressful life events, or social aspects (Schou, 2000). Furthermore, this author concluded that economics, culture, knowledge, health beliefs, fear, and dentist-patient interaction are important variables associated with treatment compliance.

In this sample, patients who initially, were ready to change their oral health behaviour demonstrated the best treatment adherence. According to the Stages of Change Model (Prochaska, DiClemente, 1983 and 1986; DiClemente, Prochaska, 1998), patients should be considered as a heterogeneous group in relation to behaviour change; depending on their readiness to change, they will have different needs, and must be treated accordingly. For instance, ... "if a change feels important to you, and you have the confidence to achieve it, you will feel more ready to have a go, and more likely to succeed" (Rollnick et al., 1999). According to this model, behaviour change is a process. Patients have altering levels of motivation or readiness to change; patients may progress and/or relapse through the five stages (Precontemplation, Contemplation, Determination or Preparation, Action, and Maintenance) (Nutbeam, Harris, 2004). Readiness to change may

vary between and within appointments. Therefore, in future studies, a formal assessment method should be used to identify readiness to change (1) prior to introduction of oral health education procedures and (2) during the study in order to track reasons for variation in level of success among those who attempt to change.

Diet

An inability to modify diet habits in the short-term was observed. In a review of the role of diet in dental caries prevention, van Loveren (2001) concluded, “most efforts to limit sugar consumption in the population are not very successful”. According to the author, “dietary variables alone have never explained more than 6% of the variance in caries increment”. This inability to modify diet means that efforts must be concentrated on other caries risk factors that can be changed, and for which their effectiveness is supported by a strong evidence base, such as fluoride exposure, oral hygiene, and monitoring of disease activity (Kay, Locker, 1996; Kay, Locker, 1998).

Patient response and reaction to new approach

As patients volunteered to participate in the study, their response to the proposed approach to caries management was surprising since they all agreed to have a non-invasive treatment. In fact, it was highlighted by the majority of them that they were ready to try a treatment approach that would really deal with the causes of dental caries rather than to return to the clinic to have other round of failed restorations associated with pain.

Therefore, it was important to help patients understand the benefits of this new approach focusing on the positive outcomes that could be achieved such as ability to eat, to socialize, and smile again. Joffe (2000) reported that the evocation of positive messages, which leads to acceptance and further behaviour change, are more efficient than fearful messages. During the audit patients realized that they were able to rescue the situation and maintain their oral health.

Limitations of the study

This study was an audit of the work conducted in the CMC. It was not a clinical trial in which the baseline and follow-up measurements were carried out independently of the researcher. In these circumstances it was not practical for the researcher/operator to be blinded to all of the clinical findings at the 6-month follow-up and, therefore, to contribute to the reduction in measurement bias. However, the follow-up bitewing radiographs were read without reference to the baseline readings. Further, the other main clinical diagnostic criteria used were clear-cut and, therefore, give rise to data that is objective. Hence, it is unlikely that the main study findings have been invalidated through measurement error or bias.

Another limitation of this study is related to the small number of patients, only 20, who had been followed for at least six months at the time when the audit ceased. Despite the fact that there were promising results, data covering only six months is not really a sufficient basis for planning long-term change. It is suggested that these patients should be followed for at least two years in order to have a strong basis to consider shifting the general treatment approach at the WCOH.

The findings presented here refer only to patients who returned for dental care; they are not calculated on an "intention to treat" basis. Therefore, they may be generalised to indicate potential outcomes for patients who are prepared to return for ongoing preventive care.

Another issue is the contribution to the program by only one other dentist, who had other responsibilities and was frequently not available in the clinic for extended periods. As a consequence, in relation to the longer-term operation of the clinic, corporate memory may fade, and opportunities for teamwork have been lost.

Main findings of the study and audit

The main findings of the study and audit after six months were:

Smooth surface lesions

- 99% of non-proximal surfaces at baseline remained sound.
- 70% of non-cavitated carious lesions observed at baseline had remineralized.

- Nine new lesions were observed.

Cavitated lesions

- 24 soft-based cavities became hard and black after treatment with fluoride varnish.

Bitewing radiolucencies

- Three new lesions were observed.
- 95% of proximal sound surfaces at baseline, as diagnosed from bitewings, remained sound.
- About half of surfaces given bitewing scores of grade 1 or 2 had regressed.
- Two surfaces scored grade 1 deteriorated.
- Most of the surfaces scored grade 4 initially were associated with lesions that were later restored with GIC.

Recurrent caries

- None of the GIC restorations, followed for six months, presented with recurrent caries.

Gingival status

- A significant 42% increase in gingival sites scored as GI=0.
- A significant 21% decrease in gingival sites scored as GI=2 compared to baseline.
- Patients who were ready to change their oral health behaviour were nearly two and a half times more likely to improve their gingival status and maintain it.

Diet changes

- Patients were unable to change their diets after three months.

Conclusion

In conclusion, the results of this study and audit revealed that the implementation of the mainly non-invasive approach to caries management in a clinic for high risk patients was effective, at least within the scope of this short-term review. The hypothesis, that the oral health and oral status of patients attending the CMC will not continue to deteriorate, was confirmed.

Recommendation

The results of this audit suggest that the Caries Management Clinic should continue to pursue caries management along the lines of the CMS, and that the situation should be monitored and formally reviewed again, perhaps, in two years time.

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APPENDICES

Appendix A: The Caries Management System and associated protocols



The University of Sydney

The Caries Management System

What does the Caries Management System involve ?

The Caries Management System involves:

1. diet assessment
2. plaque assessment
3. bitewing radiograph assessment
4. caries risk assessment
5. preparation of treatment plan
6. case presentation where patient is informed about:
 - dental caries
 - ☐ arrest
 - ☐ reversal/natural repair (remineralisation)
 - ☐ prevention
 - ☐ number and status of current lesions
 - ☐ current risk status
 - ☐ role of dentist in caries prevention and management
 - ☐ role of home care in caries prevention and management
 - result of diet assessment and recommendations
7. oral hygiene instruction
8. topical fluoride application (professional and home care)
9. monitoring plaque control at each visit
10. monitoring treatment outcomes via recall system tailored to risk status

The Caries Management System

The Caries Management System is a strategy that was designed for implementing the Caries Management Policy. This policy was developed by the Curriculum Content Committee (10 April 2003) and adopted by the Faculty of Dentistry, University of Sydney.

Both dental caries *risk* and dental caries *treatment* is managed according to The Caries Management System during various stages throughout patient consultation and treatment. At some of these stages, the details of what will occur are defined in a set of documents of which the *Caries Management Policy* is the first.

Stages and details of The Caries Management System

HISTORY

Student will:

- administer *Usual 24 hour diet questionnaire*

CLINICAL EXAMINATION

Student will:

- complete *Plaque report form*
- conduct a caries examination according to *existing policy**
- take bitewings and interpret them according to *Caries management policy*
- complete *Bitewing radiographic assessment form* (WSDR-007)
- determine patient caries risk according to *Caries management policy*

TREATMENT PLAN

Student will:

- Interpret bitewing findings according to:
 - ☐ patient risk (as above)
 - ☐ other considerations according to *Caries management policy*

TREATMENT

Student will:

- explain the *Tooth decay pamphlet* (the dental caries information sheet for patients)
- discuss the results of the *Usual 24 hour diet questionnaire*
- give oral hygiene instruction according to *Oral hygiene instruction protocol*
- and issue the pamphlet *Good oral care* (includes *Toothbrushing goals* and *Diet goals*)
- address fluoride exposure according to:
 - ☐ *Topical fluoride protocol for professional care*
 - ☐ *Topical fluoride protocol for home care*
- address other operative management (see elsewhere where not related to this new material)

MONITORING

Student will:

- recall patients according to *Recall and bitewing interval protocol*

NOTES RE THE CARIES MANAGEMENT SYSTEM

Notes re *Usual 24 hour diet questionnaire*

The purpose of the questionnaire

The purpose of this questionnaire is to determine diet-related caries risk.

It is recognised that the process of changing an individual's diet is extremely complex and difficult. One of the main risk factors for caries is the *frequent consumption* of refined sugar. However, because of the complexity of the diet-caries relationship, the probability that caries risk will be reduced by reducing refined sugar is certain only in the case where there is close to a complete absence of sugar in the diet. This goal is not really possible to achieve in the world of today. While there is a sound theoretical basis for recommending that dietary sugar should be reduced, both in relation to caries and other health problems, it should be clearly understood that effective diet counseling protocols aimed at reducing dietary sugar do not exist (if they did, we would not experience this extremely complex and difficult problem).

Nevertheless, we do accept responsibility for (1) assessing risk, (2) bringing this risk to our patient's attention, and (3) advising accordingly.

Completion of the questionnaire:

There are three columns for entering data; columns A and B, and the column on the right side of the questionnaire where the number of spoonfuls of sugar in tea/coffee is entered.

1. In column A, a box is ticked only if that item is consumed.
2. Column B is completed only if the corresponding box in column A is ticked.
3. Where applicable, in column B, enter the number of cups of tea/coffee drunk on that occasion.

4. Then on the right, enter the number of spoonfuls of sugar added — do not leave these boxes blank — enter a zero in cases where sugar is not added.

On the basis of this risk assessment, you will determine the frequency of consumption of (1) between-meal sugar-containing snacks and (2) between-meal sugar-containing drinks.

If appropriate, advise your patient accordingly to reduce this intake, and in addition, enter **Diet Goals** in the boxes in the **Good Oral Care** pamphlet (see below) that you will issue to each patient. You will monitor these recommendations.

The questionnaire data, in addition to other history and clinical data, will be entered for computer analysis. You will be informed of the results.

Notes re **Plaque report form**

Purpose of the plaque report form

It is a record of **unstained** plaque deposits according to the **Plaque Index** of Silness and Loe (1965) for **monitoring** oral hygiene performance. The goal of monitoring oral hygiene performance is to **reduce** and **maintain** plaque scores at near zero values (see the **Oral Hygiene Instruction Protocol** below).

Use of the plaque report form

1. This form is to be completed at the **commencement of each visit**.
2. In relation to a new patient, the scoring is to be done **before** you give oral hygiene instruction.
3. Twelve sites are assessed - that is, the buccal and lingual surfaces of the first permanent molars (8 sites) and the buccal and lingual surfaces of the upper and lower right permanent incisors (4 sites).
4. The area on the buccal and lingual surfaces each tooth to be assessed, is the area adjacent to the gingival margin, from papilla to papilla.
5. The patient score is the sum of the individual surface scores, and has a maximum value of 36.

Notes re **Bitewing radiographic assessment**

Purpose of the bitewing radiographic assessment form

The purpose of this form is to monitor and facilitate the non-invasive management of the early **non-restored** occlusal and interproximal lesions. Radiolucencies associated with already filled occlusal and interproximal surfaces (that is, secondary caries) are not recorded on this form. Record details of radiolucencies associated with secondary caries elsewhere in the patient notes.

Recordings of future bitewing examinations (see **Recall and bitewing interval protocol** below) will also be entered on this form and will allow an assessment of the lesion dynamics. The lesions may regress, remain the same, or progress.

When this form is completed, it goes into the patient's folder.

Use of the bitewing radiographic assessment form

1. There is provision for recording radiographic status of the distal, occlusal, and mesial surfaces of each tooth excluding incisors.
2. For each surface, there are five boxes, numbered 1 to 5 corresponding to lesion depth.
3. For each surface that presents with a radiolucency, **only one box** is filled in; that being the one associated with your estimate of the deepest extent of the radiolucency.

Following the taking of readable bitewing radiographs and **before** you discuss them with your clinical supervisor, complete the bitewing radiographic assessment form (for monitoring lesion dynamics), and transfer these findings to the **Treatment plan report form (5)** - (see below).

Notes re *Tooth decay pamphlet*

The purpose of this form

This pamphlet contains essential information regarding caries on the front side, and other important information on the reverse side. This form is the main patient educational material for dental caries and provides a basis for obtaining informed consent from patients regarding the treatment plan.

Use of this form

1. Give this form to patients during the case presentation and go through it step by step.
2. Show the bitewing radiographs to your patient and draw attention to the teeth that show radiolucencies.
3. The number of radiolucencies, according to bitewing scores, will be entered as appropriate.
4. Explain to your patient how the bitewing finding is related to the *treatment need*.
5. The caries risk is also indicated in the appropriate box as per the *Caries management policy (1)*.
6. Go through the material on the reverse side of the form: *More information on tooth decay*.
7. At some point in the discussion after this, the patient will be asked if the treatment plan proposal is acceptable and may or may not give consent to proceed according to the treatment plan, or may agree to consent to some other treatment plan that is mutually acceptable.
8. Enter the date of the next appointment.

Notes re *Good oral care pamphlet*

The purpose of the pamphlet

There are three purposes for this pamphlet. The main purpose is to provide a set of illustrations showing toothbrush positions (1) for oral hygiene instruction purposes, and (2) for demonstration at future visits of tooth sites where plaque has not been removed.

The second and third purposes are: (2) to record the diet goals, and (3) to record sites where toothbrushing emphasis is required. This pamphlet complements the use of models during oral hygiene instruction.

Use of pamphlet

On the toothbrushing goals panel:

1. Enter the plaque score reduction goals that you have set for your patient.
2. Inform your patient that you will be checking oral hygiene instruction progress at the next visit.
3. Note that the order of the boxes is left - front - right, that is, the patient's mirror image.

On the diet goals panel:

1. Enter the snacking reduction and added sugar reduction goals that you have set for your patient on the basis of your analysis of the Usual 24 hour diet questionnaire (2). Be practical !! Suggestion: one less than usual ??

On the Where do I brush ? panel:

1. Draw, or highlight, or write instructions as appropriate.

Notes re *Topical fluoride protocols*

Purpose of the protocols

These protocols, based on the most recent guidelines and meta-analyses, define the topical fluoride regimen to follow for (1) professional care and (2) home care.

Use of protocols

1. Enter table according risk category
Go for it !!

ORAL HYGIENE INSTRUCTION PROTOCOL

Objective of oral hygiene instruction (OHI)

The objective of OHI is to:

- custom-make an oral hygiene program for the individual patient
- ensure that patients understand that plaque should be removed effectively, especially along gingival margins and the dental papilla
- ensure that patients given are given practical toothbrushing demonstration
 - on a model
 - and on themselves (visual and tactile)
- and to ensure that patients know that their oral hygiene status will be monitored at *every appointment to coach them in becoming effective*

Oral hygiene instruction

at first visit for each new patient the student shall:

1. introduce plaque (students should memorise the following)

The two main dental diseases, *tooth decay* and *gum disease*, are caused by bacteria in the mouth. These bacteria settle on teeth and cover the tooth surface. This covering of bacteria is called *dental plaque*.

Dental plaque is soft and is easily removed with a toothbrush. However, plaque builds up again following toothbrushing. It is invisible at first, but after one day it can be easily seen. Plaque is thickest along the gum margin. In order to see plaque more clearly, it can be stained with a dye.

Plaque bacteria that cause gum disease produce *toxins* (poisons) which irritate the gums causing *inflammation* (redness).

The bacteria that cause tooth decay feed on sugar in our diet and produce acids which dissolve the hard tooth enamel and may cause a hole.

When we brush our teeth most of us now do it automatically. But even though we do it without having to think about, it may not be effective. So, I am going to custom make a program just for you to help you relearn how to do it well enough to help prevent dental disease.

2. ask the patient where the teeth are brushed. "Is this in front of a mirror?"
3. ask the patient, "When did you last brush your teeth?"
4. have patient observe own teeth in a hand mirror
5. if no visible plaque, demonstrate Plaque Index score of 1 (where on an apparently clean surface, plaque can be picked up with a probe)

however, most patients will have some visible plaque, especially along the linguals of the lower 6s

You may omit steps 6 to 14.

6. apply disclosing solution and show patient the distribution of stained plaque
7. chart stained plaque distribution (patient folder or student workbook)
8. demonstrate the stained plaque - use the mouth mirror to aid reflection in the hand mirror
9. complete patient the *Good tooth care pamphlet* - for patient to take home
10. show patient how to read the *Good tooth care pamphlet*
11. provide a toothbrush and ask patient to remove the (stained) plaque - and observe their toothbrushing method, and sequence of going around the sextants
12. check result and demonstrate and in the mouth and on the models where they have missed, what movements to use to brush the teeth effectively
13. patient to remove the remaining (stained) plaque

14. check patients efforts and give further advice, and repeat once more if necessary
15. give the patient a prophylaxis - as a baseline and because it feels good and makes patients happy, and will assist motivating them
16. demonstrate that plaque cannot be disclosed on the prophylaxed teeth
17. set goals for patient (for example, if today, thick plaque is visible in all sextants - score 36 - then at next visit aim for score 24)
18. then, explain to patient that their oral hygiene will be checked first thing at next appointment as a coaching aid to relearning how to brush effectively
19. now, talk about fluoridated toothpaste
20. ask patient to bring his/her toothbrush at next visit
21. **DO NOT DISCUSS FLOSSING AT THIS FIRST VISIT UNLESS PATIENT ASKS** - it is far more important for patients to become expert at toothbrushing. When patients demonstrate expertise in brushing, you may consider flossing.

at second visit

1. ask how they think their brushing is going and explain process
2. complete the *Plaque report form* (it is not necessary to stain plaque, but you may do so)
3. compare result with first visit - did patient improve
4. if yes, praise patient and give encouragement
5. redemonstrate Plaque Index score 1 because this illustrates that we give priority to oral hygiene and that toothbrushing needs detailed care and attention - the aim is for as many surfaces as possible to have score 0
6. ask patient a brush and ask them to remove the (stained) plaque (if patient did not bring back toothbrush, issue another)
7. discuss results
8. redemonstrate brushing technique
9. set new goals
10. complete the *Good oral care* - for patient to take home
11. remind patient how to read the Good oral care pamphlet
12. advise patient that results will be checked again first thing next visit as a coaching aid for them
13. ask patient to bring his/her toothbrush at next visit

third and subsequent visits

1. do not stain plaque this time
2. complete the *Plaque report form* (it is not necessary to stain plaque, but you may do so)
3. complete the *Good oral care* - for patient to take home
4. we expect a real improvement - there should **definitely be no PII scores of 3** and few PII scores of 2
5. if not, investigate the barriers
 - is it that patient **cannot**, or **will not** brush effectively
 - **if cannot**, then identify the problem and demonstrate an effective new technique or apparatus, eg special brush, special handle
 - **if will not**, then this is serious, **why is the patient coming here** - it is our responsibility to ensure that the patient understands that oral health is almost entirely dependent upon home care - the preventive treatment will fail and oral health will deteriorate if home care is not followed
6. as time goes on, introduce the concept of bleeding on probing, that is Gingival Index score 2 (an inflamed margin that bleeds on probing, or better still, 6 site bleeding on probing (BOP))
7. when PII scores are mostly 0 and corresponding GI scores are mostly 0, the oral hygiene status is good and indicates a low caries risk
8. if patients wish to improve beyond this point, consider dental floss, **but do not introduce dental floss until it is certain that patient has demonstrated a high level of motivation - the evidence is maintenance of low plaque scores over many visits**
9. if gingivitis is controlled, that is, Gingival Index scores are 0 or 1, but BOP occurs with 6-point probing, then the diagnosis is likely to be a localised periodontal problem and that this problem should now be investigated

RECALL AND BITEWING INTERVAL PROTOCOL

Recall at the following times:

Low risk

- 12 months following completion of treatment plan developed at first visit
- then consider 18-24 month recalls

Medium risk

- 6 months following completion of treatment plan developed at first visit
- then 6-monthly until patient is classified as low risk

High risk

- 3 months following completion of treatment plan developed at first visit
- then 3-monthly until:
 1. home care goals have been met
 - ☐ diet modification
 - ☐ oral hygiene
 - ☐ fluoride therapy
 2. lesion progression has arrested/reversed (that is, patient is reclassified as medium/low risk)

Bitewing radiographs should be taken following times:

Low risk

- at first visit
- then 12 months later
- then every 18-24 months

Medium risk

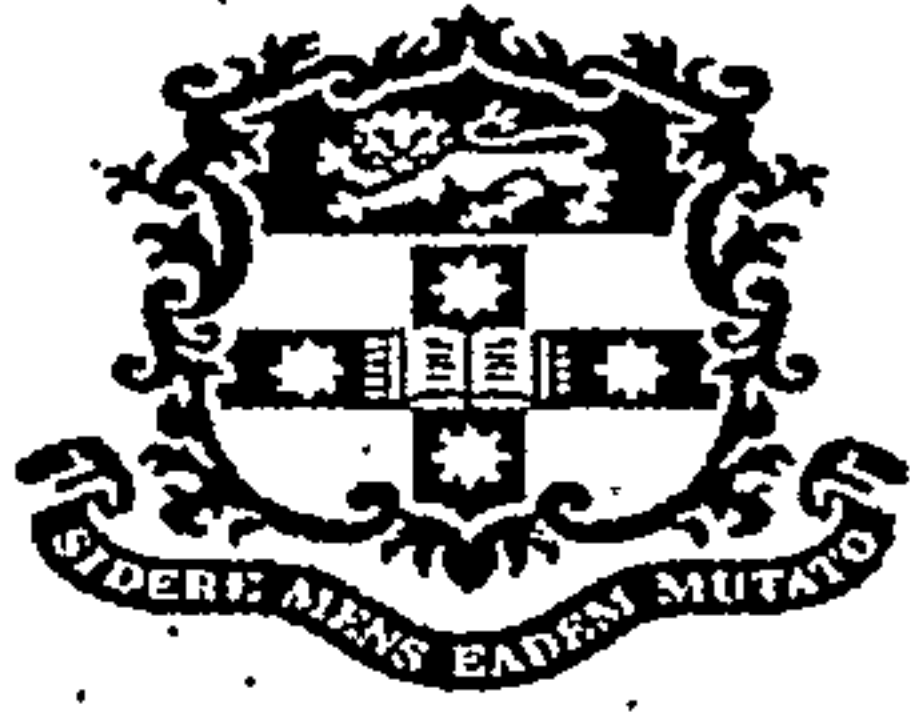
- at first visit
- then 6 monthly until patient becomes low risk

High risk

- at first visit
- then 6 monthly until patient becomes low risk

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13 February 2006



The University of Sydney

CARIES MANAGEMENT POLICY Faculty of Dentistry

Caries management centres on (1) the patient at risk, (2) the status of each lesion, (3) clinical management, (4) patient management, and (5) monitoring.

THE PATIENT AT RISK

Dental caries is an infectious disease. A patient *at risk* is one who maintains a reservoir of the infecting bacteria (plaque) and whose caries susceptibility is increased due to a combination of one of more other *primary* factors:

- inadequate saliva (amount, composition)
- inadequate fluoride exposure
- excessive dietary sucrose or other fermentable carbohydrate
- unfavourable tooth morphology/tooth site

and *secondary confounding* factors:

- social class
- education level
- knowledge
- attitudes
- behaviour

Patient caries risk categories

In relation to risk categorisation of a *new* patient:

High risk = patient presenting with:

- untreated frank cavities
- and/or extensive and friable white spot lesions
- and/or bitewing radiolucencies of *Grades 4 or 5*

Very high risk = patient presenting with rampant caries as seen in many people taking methadone.

Medium risk = patient presenting with:

- no frank cavitation
- but may have sticky pit/fissures
- and/or bitewing radiolucency(s) not greater than *Grade 4*

Low risk = patient presenting with:

- no clinical signs of caries
- but may have bitewing radiolucency(s) not greater than *Grade 3*

and in relation to risk categorisation of a *recall* patient:

High risk = new lesion incidence of >1 per year

Medium risk = new lesion incidence of 1 per year

Low risk = new lesion incidence of <1 per year

The outcome of dental treatment is highly dependent on home-care personal efforts. Hence, patient risk is also subject to secondary confounding factors. You may judge (sometimes referred to as the social diagnosis) that success in reducing patient risk is likely to be:

- favourable
- uncertain
- unfavourable

Hence, a high risk patient with an unfavourable rating is likely not to respond well to the benefit of dental care.

STATUS OF THE CARIES LESION

The status of the caries lesion may be:

- active (progressive, quiescent, regressive)
- arrested

and the affected surface may be:

- cavitated
- demineralised to varying degrees
- at the point of cavitation

CLINICAL MANAGEMENT

The management options are:

- preventive
- preservative (non-invasive)
- conservative operative procedures (invasive)

The approach taken, as noted above, centres on patient and lesion management.

Lesion management

- *arrested* lesions should be managed preventively to maintain this desired status (see elsewhere)

- *cavitated* lesions should be managed via conservative operative procedures
- *active non-cavitated* lesions should be arrested via a protocol of *non-invasive* measures that address the causative factors noted above

PATIENT MANAGEMENT

The management of the *at-risk patient* entails the development (by the dentist) of a firm understanding of the situation of the at-risk patient (via the patient history and clinical examination) and then obtaining *patient co-operation* to implement a suitable protocol that will deliver a package of *non-invasive* measures designed to *arrest active non-cavitated lesions*, and once arrested, to *maintain arrest*. This process is facilitated through use of the **TOOTH DECAY** pamphlet which gives details of the causes and prevention of caries, and on which is recorded the clinical status of the patient and risk status. This pamphlet is presented to the patient at the *case presentation*.

Patient history and clinical examination

Via the history and clinical examination, the status of the following potential causative factors may be diagnosed:

- sucrose intake
- fluoride exposure
- plaque and plaque control habits
- tooth morphology
- salivary characteristics (principally flow rate and microbiology)

Treatment planning with reference to evidence based protocols

Then a protocol is developed that will address each causative factor diagnosed as contributing to the problem:

- diet monitoring
- an appropriate fluoride exposure via professional and home application
- plaque control via professional and personal inputs - intensive coaching
- fissure sealant application, elimination of restoration overhangs and undercuts, elimination of prosthetic plaque traps
- saliva substitutes or other appropriate management including monitoring of salivary bacteria
- recall schedule appropriate to patient risk status

Case presentation and the responsibilities of clinician and patient

The administration of the protocols entails patient counseling where the clinician plays a pivotal role - the clinician must assume a *prime responsibility* to ensure that patients understand that home care is the key to caries prevention and that patients themselves are largely responsible for their oral health. Other than coaching and facilitating a monitoring program, the clinician can do little more for oral health in any environment, some of which are exposed to more risk factors than others.

MONITORING CARIES ACTIVITY

Monitoring has a dual focus on patient response and caries activity

Patient response

How is the patient responding to coaching? The following need to be monitored for life:

- diet control
- plaque control
- fluoride exposure
- saliva control

Diet monitoring

See notes given elsewhere. A diet diary and associated analysis from time to time enables trends to be identified and discussed.

Plaque control monitoring

At each appointment, record surfaces that demonstrate visible plaque and give a copy to the patient with related advice. Or, later, relate these sites to bleeding on probing. If sites do not bleed on probing, periodontists consider that these have been sufficiently cleaned. Such level of cleaning is probably sufficient for caries control too.

The active demonstration of recording plaque/BOP and reviewing serial findings at each visit motivates patients to improve and maintain high levels of oral hygiene.

Saliva monitoring

See notes given elsewhere.

Fluoride exposure monitoring

More than any other factor, fluoride exposure is the key to caries management. In the absence of a positive response to caries arrest, fluoride exposure

can be increased, since it is the least bothersome factor for the patient to manage well.

Lesion activity - clinical and radiographic monitoring

- bitewing radiolucency activity
- carious white spots
- exposed roots
- surfaces along restoration margins and prosthesis abutments

are in need of careful scrutiny at recall appointments.

Bitewing radiographs should be taken at intervals appropriate to the risk status of the patient. Suitable guidelines may be:

- *low risk* at 2-yearly intervals
- *medium* at yearly intervals
- *high risk* at 6-monthly intervals

The purpose of radiographic monitoring is to evaluate the status of proximal lesions and pit/fissure lesions. Note that one set of bitewings *cannot* indicate progression/regression - a dated series is necessary.

Radiolucency status grades

For proximal lesions, the bitewing radiolucency grades are:

- 0 no radiolucency evident
- 1 a radiolucency is evident in the *outer half* of enamel
- 2 a radiolucency extends into the *inner half* of enamel and may reach the DEJ
- 3 a radiolucency extends *just* beyond the DEJ
- 4 a radiolucency is evident in the *outer third* of dentine
- 5 a radiolucency extends into the *inner two thirds* of dentine and may reach the pulp

Recording bitewing findings

Bitewings are special tests and it is the responsibility of the dentist who ordered them to (1) read them and (2) to date and record the findings, either on the dental chart (odontogram) or somewhere readily accessible in the patient notes. Both the tooth site and radiolucency grade should be entered.

Interpretation of bitewing findings

For new patients for whom you do not have serial bitewing records, treat as follows.

In the *absence of symptoms*, the best option for surfaces associated with bitewing radiolucency grades:

- 1 do not restore*
- 2 do not restore*

- 3 do not restore*
- 4 do not restore without further consideration
- 5 restore now

* Follow topical fluoride protocols for professional and home care application as per patient caries risk category.

Further consideration for surfaces associated with a Radiolucency Grade of 4

Low and medium risk children and adolescents

- restore *only if* the radiolucency extends *fully 1/3* into dentine
- *otherwise do not restore* because it is more likely than not that the *proximal surface is not yet cavitated*
- implement *preventive strategy* (1) to arrest and remineralise active lesions or (2) to maintain arrested lesions

Low and medium risk adults (Age > 18 years)

- restore *only if* the radiolucency extends *fully 1/3* into dentine
- *otherwise do not restore* because (1) it is more likely than not that the proximal surface *is not cavitated* and (2) that the lesion *has arrested*
- implement *preventive strategy* (1) to arrest and remineralise active lesions or (2) to maintain arrested lesions

High risk children, adolescents, and adults

- restore now
- implement strategy (1) to arrest and remineralise lesions not yet showing radiographically and (2) to prevent recurrent caries

At recall appointments, compare the radiolucency status on new bitewings with that of earlier series, and note any changes:

- radiolucency regression or no change indicates caries arrest - maintain preventive protocol.
- radiolucency extension and or the appearance of new lesions indicates caries active status and lesion progression - reapply and maintain the non-invasive strategy with greater urgency

- some invasive intervention may be warranted - lesions should be treated according to their new radiolucency grade

THE EVIDENCE

See notes on *Caries dynamics* for evidence underpinning the principles of the non-invasive approach to caries management, and see other notes on caries prevention via:

- diet modification
- toothbrushing
- topical fluoride
- water fluoridation
- fissure sealants

And see notes on the *Capacity for prevention* for the evidence base concerning the success of the non-invasive approach to caries management.

Related Documents

- Bitewing caries report form
- Dental caries information pamphlet
- Non-invasive management of dental caries
- The patient at risk

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and edited in accordance with the consensus reached at the
Curriculum Content Committee Meeting, 10 April 2003

TOPICAL FLUORIDE PROTOCOL FOR PROFESSIONAL CARE

RISK CATEGORY	AGE GROUP IN YEARS	FLUORIDE VARNISH (DURAPHAT) 5% NaF (22,600 ppm) GIC (Fuji 7)	FLUORIDE GEL 1.23% NaF (12,300 ppm)
LOW RISK	2-6	<i>For all age groups:</i> 1. Apply GIC (eg Fuji 7) or varnish to newly erupted permanent molars. 2. Yearly application on lesions until arrested.	NOT TO BE USED <i>For age-groups aged 7 and above</i> 1. At recall appointments to maintain lesion arrest.
	7-12 13-18 19 plus		
MEDIUM RISK	2-6	<i>For all age groups:</i> 1. Apply GIC (eg Fuji 7) or varnish to newly erupted permanent molars. 2. Apply to all lesions <i>at each treatment session</i> , then 3. 6-monthly application on lesions until patient becomes low risk.	NOT TO BE USED NOT APPLICABLE
	7-12 13-18 19 plus		
HIGH RISK	2-6	<i>For all age groups:</i> 1. Apply GIC (eg Fuji 7) or varnish to newly erupted permanent molars. 2. Apply to all lesions <i>at each treatment session</i> , then 3. 3-monthly application on lesions until patient becomes medium risk.	NOT TO BE USED NOT APPLICABLE
	7-12 13-18 19 plus		

TOPICAL FLUORIDE PROTOCOL FOR HOME CARE

RISK CATEGORY	AGE GROUP IN YEARS	TOOTHBRUSHING WITH FLUORIDE TOOTHPASTE	RINSE 0.05% NaF (neutral) (220 ppm) ONE MINUTE	GEL Chlorhexidine 0.2% CHX
LOW RISK	2-6	Daily using 400 ppm (smear only)	NOT TO BE USED	NOT APPLICABLE
	7-12	Twice daily using 1000 ppm (pea size)	NOT APPLICABLE	
	13-18 19 plus			
MEDIUM RISK	2-6	Daily using 400 ppm (smear only)	NOT TO BE USED	NOT APPLICABLE
	7-12	Twice daily using 1000 ppm (pea size)	NOT APPLICABLE	
	13-18 19 plus	Twice daily using 1000 ppm (pea size)	Once daily at a separate time from toothbrushing	
HIGH RISK	2-6	Daily using 400 ppm (smear only)	NOT TO BE USED	NOT APPLICABLE
	7-12	Twice daily using 1000 ppm (pea size)	NOT APPLICABLE	
	13-18 19 plus	Twice daily using 5000 ppm (pea size)	APPLICABLE	
VERY* HIGH RISK	Age groups above 12 years	Twice daily using 5000 ppm (pea size).	NOT APPLICABLE	Once daily before bed

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

My toothbrushing goals

My diet goals

Good oral care

Upper teeth

Outsides
(cheek & lip sides)

--	--	--

Left Front Right

Insides
(facing tongue)

--	--	--

Left Front Right

Lower teeth

Outsides
(cheek & lip sides)

--	--	--

Left Front Right

Insides
(facing tongue)

--	--	--

Left Front Right

When you have become expert at using your toothbrush, you may consider using dental floss.

Reduce

1. Between meal snacking to

occasions.

2. Sugar added to tea/coffee/etc to

spoonfuls.

FOR FURTHER INFORMATION

Contact:

Community Oral Health & Epidemiology

Facsimile: (02) 9845 8306



University of Sydney

In order to remove bacterial plaque and prevent tooth decay, brush your teeth twice daily with fluoride toothpaste before bed and in the morning.

Take care to do a good job with your brushing, especially along the gum margins.

The five toothbrushing steps

1. Put teeth together— Brush outsides of the front teeth starting at gum margins.
2. Then outsides of back teeth Top and Bottom – Left and Right.
3. Don't miss the corners when you turn from one side to the other.
4. Next brush the chewing surfaces Top and Bottom – Left and Right.
5. Finally brush insides of teeth – Top and Bottom – Left and Right.

The Restoration Protocol

Policy of the Caries Management Clinic (CMC):

- Initially, lesions in need of immediate operative care are to be restored temporarily with GIC.
- At the 6-month follow-up, the temporarily restored surfaces are to be replaced with tooth coloured (if applicable) restorations, provided that patients qualify to receive this care. In order to qualify, patient needs to demonstrate that in six months:
 - Low plaque scores are maintained
 - No recurrent caries
 - No new primary carious lesion
 - Baseline early carious lesions have arrested
- Patients who failed to qualify for definitive restorative care will, nevertheless, be offered definitive care and will be counselled on their associated risks.

Appendix B: Ethics approval

SYDNEY WEST AREA HEALTH SERVICE

HUMAN RESEARCH ETHICS COMMITTEE

Research Office, Clinical Sciences
Westmead Hospital Campus
Westmead NSW 2145

Telephone: 02 9845 8183
Facsimile: 02 9845 8352
Email: researchoffice@westgate.wh.usyd.edu.au

In reply please quote:

HS/pme HREC2005/2/4.27(2032)

Committee Secretariat:

Professor Stephen Leeder
Chairman
Professor of Public Health &
Community Medicine

Dr Howard Smith
Secretary
Medical Graduate -
Endocrinologist

Committee Members:

Mr Leonard Burney
Layman

Dr Michael Cole
Medical Graduate - Neonatal
Paediatrician

Mrs Patricia Fa
Clinical Trials Pharmacist

A/Prof Lorraine Ferguson
Nursing Research Unit

Mr John Fisher
Lawyer

Ms Jillian Gwynne Lewis
Patient Representative

Dr Anthony Harris
Medical Graduate -
Psychiatrist

A/Prof Ian Kerridge
Haematologist and Bioethicist

Ms Rada Kusic
Clinical Trials Manager

Mr John Shaw
Layman

Dr Geoff Shead
Medical Graduate - Surgeon

Rev Bruce Stanley
Minister of Religion

Rev Janine Steele
Minister of Religion

Ms Shane Waterton
Laywoman

Miss Freda Whitlam AM
Laywoman

Ms Gillian Wyatt
Laywoman

5 May, 2005

A/Prof R.Wendell Evans
Community Oral Health & Epidemiology
Westmead Centre for Oral Health

Dear Professor Evans

Research Proposal: An audit of caries management in the Caries
Management Clinic, Westmead Centre for Oral Health

Thank you for forwarding your revised Participant Information and Consent Forms Version 2 dated 5 April 2005 together with the signed letter of acceptance, all in accordance with the requests of the Human Research Ethics Committee letter dated 15 March 2005.

As the Committee's ethical concerns have now been satisfied, approval of the study is confirmed and it may now commence. A copy of the approved Participant Information and Consent Forms Version 2 dated 6 April 2005 is attached for your records.

The Committee wishes you well with the study and looks forward to receiving progress reports in due course.

Yours sincerely



Dr Howard Smith
Secretary
Sydney West Area Health Service
Human Research Ethics Committee



The University of Sydney

NSW 2006 Australia

Human Research Ethics Committee

www.usyd.edu.au/ethics/human

Manager:

Gail Briody

Telephone: (02) 9351 4811

(02) 9351 4474

Facsimile: (02) 9351 6706

Email: gbriody@mail.usyd.edu.au

Rooms L4.14 & L4.13 Main Quadrangle A14

Human Secretariat

Telephone: (02) 9036 9309

(02) 9036 9308

(02) 9351 4474

Facsimile: (02) 9036 9310

Email: r.todd@reschols.usyd.edu.au

10 June 2005

Associate Professor W Evans
Faculty of Dentistry
Westmead Centre for Oral Health
Westmead Hospital
C24

Dear Professor Evans

Title: **An audit of caries management in the Caries Management Clinic, Westmead Centre for Oral Health**
Masters Student: Dr Alexandra Sbaraini

Reference No.: **8392**

Your recent application has been noted by the Executive Committee of the Human Research Ethics Committee and in doing so accepts the final approval from the Sydney West Area Health Service Human Research Ethics Committee.

In considering the ethical content of the study, the Committee acknowledges the right for you to proceed under the authority of the Sydney West Area Health Service Human Research Ethics Committee.

It is the responsibility of the Chief Investigator to provide a progress report every twelve months for the duration of the study and a final report on the completion of the study. Your report will be due on 30 June 2006.

The responsibility for complaints by participants about the research process will remain with the Sydney West Area Health Service Human Research Ethics Committee.

Yours sincerely

Gail Briody
Manager, Ethics Administration

Appendix C: Participant information and consent form



PARTICIPANT INFORMATION

Title of Project: "An audit of caries management in the Caries Management Clinic, Westmead Centre for Oral Health"

Name(s) of Investigator(s):

Chief Investigator/Supervisor: Associate Professor Wendell Evans

Co-Researchers: Dr Heather Cameron and Dr Ilana Fisher

Student: Dr Alexandra Sbaraini

What is the purpose of the study?

The study objective is to measure how much existing tooth decay can be arrested and reverted by topical fluoride (painted on your teeth) and also to measure how much tooth decay can be prevented in high risk individuals by topical fluoride (fluoride toothpaste).

Who will be invited to enter the study?

All patients attending the Caries Management Clinic, Westmead Centre for Oral Health, are being invited to participate in this study.

What will happen on the study?

High strength topical fluoride will be put on your teeth at the dental clinic, and you will receive detailed instructions on home care. Your toothbrushing performance and home use of fluoride toothpaste will be checked at each appointment. Your new fillings and x-rays will be checked at a recall appointment to make sure that no new decay has developed.

Are there any risks?

There are no known risks associated with using topical fluoride in this intensive program. The most important part of the program is your home-care and our monitoring of your situation. However, unless you are prepared to follow the home-care instructions and return for monitoring, your high risk of decay will continue.

Confidentiality:

All aspects of this study, including results, will be strictly confidential and only the researchers will have access to your personal information. Any publication of the results from this study will only use de-identified information.

Compensation:

Every reasonable precaution will be taken to ensure your safety during the course of this study. If you suffer any serious injuries or complications as a result of this study, you should, as soon as possible, contact the study doctor who will arrange appropriate medical treatment free of charge in any Australian public hospital.

Your participation in this study will not affect any right to compensation that you might have under statute or common law for any injuries or complications resulting from this study, caused by unsafe drugs or equipment or negligence.

Do you have a choice?

Participation in this study is entirely voluntary. If you choose not to join the study, or you wish to withdraw from it at any time, your care will not be affected in any way.

Participant's Name

Signature

Date



The University of Sydney

SYDNEY WEST

Area Health Service

Title of Project: "An audit of caries management in the Caries Management Clinic, Westmead Centre for Oral Health"

Complaints:

If you have any concerns about the conduct of the study, or your rights as a study participant, you may contact the Westmead Hospital Patient Representative, Ms Jillian Gwynne Lewis, Telephone No 9845 7014 or email jillian_lewis@wsahs.nsw.gov.au

Contact details:

If you have any problems while on the study, please contact Dr Wendell Evans

Working hours Telephone No -9845 7537

After hours please contact:

Accident & Emergency 9845-6520



The University of Sydney

SYDNEY WEST
Area Health Service

CONSENT TO PARTICIPATE IN RESEARCH

Title of Research Project:

“An audit of caries management in the Caries Management Clinic, Westmead Centre for Oral Health”

Name of Researcher:

1. I understand that the researcher will conduct this study in a manner conforming with ethical and scientific principles set out by the National Health and Medical Research Council of Australia and the Good Clinical Research Practice Guidelines of the Therapeutic Goods Administration.
2. I acknowledge that I have read, or have had read to me the Participant Information Sheet relating to this study. I acknowledge that I understand the Participant Information Sheet. I acknowledge that the general purposes, methods, demands and possible risks and inconveniences which may occur to me during the study have been explained to me by _____ ("the researcher") and I acknowledge that I understand the general purposes, methods, demands and possible risks and inconveniences which may occur during the study.
3. I acknowledge that I have been given time to consider the information and to seek other advice.
4. I acknowledge that refusal to take part in this study will not affect the usual treatment of my condition.
5. I acknowledge that I am volunteering to take part in this study and I may withdraw at any time.
6. I acknowledge that this research has been approved by the Sydney West Area Health Service Human Research Ethics Committee.
7. I acknowledge that I have received a copy of this form and the Participant Information Sheet, which I have signed.

Before signing, please read 'IMPORTANT NOTE' following.

Name of participant _____ Date of Birth _____

Address of participant _____

Signature of participant _____ Date: _____

Signature of researcher _____ Date: _____

Signature of witness _____ Date: _____

Participant's Name

Signature

Date _____



IMPORTANT NOTE

This consent should only be signed as follows:

1. Where a participant is over the age of 16 years, then by the participant personally.
2. Where the participant is between the age of 14 and 16 years, it should be signed by the participant and by a parent or guardian.
3. Where the participant is under the age of 14 years, then the parent or guardian only should sign the consent form.
4. Where a participant is under a legal or intellectual disability, eg unconscious, then particular consent should be sought from the Human Research Ethics Committee as to whether the person should take part in the research.

INDEPENDENT WITNESS:

I, _____ (name of independent witness)

of _____ hereby certify as follows:

1. I was present when _____ ("the participant") appeared to read or had read to him / her a document entitled Participant Information Sheet; or I was told by _____ ("the participant") that he/she had read a document entitled Participant Information Sheet (*Delete as applicable)
2. I was present when _____ ("the researcher") explained the general purposes, methods, demands and the possible risks and inconveniences of participating in the study to the participant. I asked the participant whether he/she had understood the Participant Information Sheet and understood what he/she had been told and he/she told me that he/she did understand.
3. I observed the participant sign the consent to participate in research and he/she appeared to me to be signing the document freely and without duress.
4. The participant showed me a form of identification which satisfied me as to his/her identity.
5. I am not involved in any way as a researcher in this project.
6. (Delete this clause if not applicable) I was present when _____ ("the interpreter") read the Participant Information sheet to the participant in the _____ (here insert appropriate language) language. I certify that when the researcher explained the general purposes, methods, demands and possible risks and inconveniences of participating in the study that what was said by both the researcher and the participant was translated by the interpreter from the English language into the _____ language and vice versa. When I spoke to the participant what I said and what the participant said was translated by the interpreter from the English language into the _____ language and vice versa.

Name of independent witness _____

Address _____

Signature of independent witness _____ Date: _____

Relationship to participant of independent witness _____



CONSENT TO PARTICIPATE IN RESEARCH

INTERPRETER:

If an interpreter is used, the following addition is necessary –

I _____ (name of interpreter)

of _____ certify as follows:

1. I am qualified to translate speech and writing from the English language into the _____ language and vice versa.
2. I read the Participant Information Sheet to the participant in the _____ language and he/she appeared to understand it.
3. I was present when the researcher explained the general purposes, methods, demands and possible risks and inconveniences of participating in the study to the participant and I translated all that was said by the researcher and by the participant from the English language into the _____ language and vice versa.
4. I was present when the independent witness spoke to the participant and I translated all that was said by the independent witness and by the participant from the English language into the _____ language and vice versa.

Signature of Interpreter _____ Date _____

Appendix D: Medical and dental questionnaire

Hospital/Community Health Centre		M.R.N.	
Title		Family name	
Given names			
DOB	Sex	Consultant	Ward/Unit

Medical Alerts:

Allergies:

Condition: Please tick ☒	Yes	No
Cardiovascular system	☐	☐
Rheumatic fever	☐	☐
High blood pressure	☐	☐
Bleeding	☐	☐
Respiratory system	☐	☐
Central nervous system	☐	☐
Diabetes	☐	☐
Thyroid	☐	☐
Infectious disease	☐	☐
Musculoskeletal system	☐	☐

Condition: Please tick ☒	Yes	No
Immune disorder	☐	☐
Gastro-intestinal system	☐	☐
Uro-genital system	☐	☐
Liver	☐	☐
Cancer	☐	☐
Pregnant	☐	☐
Medication	☐	☐
Allergies	☐	☐
Hospital admission/operations	☐	☐
Recreational drug use	☐	☐

Date	Medical history details	Clinician signature

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Medical history

Medical history

[illegible]

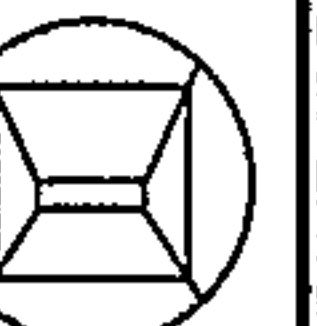
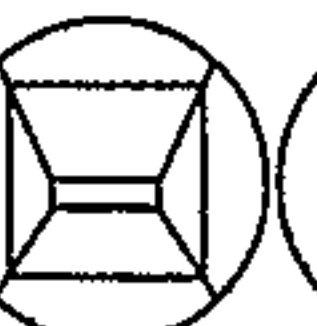
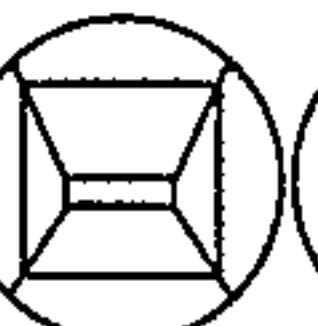
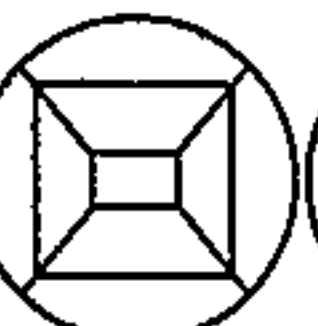
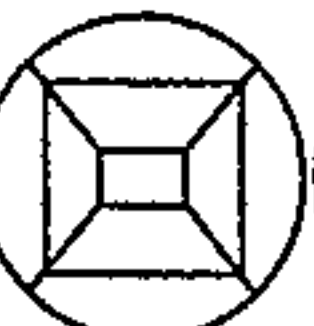
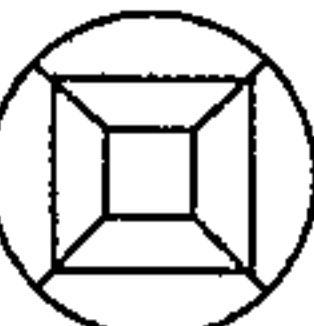
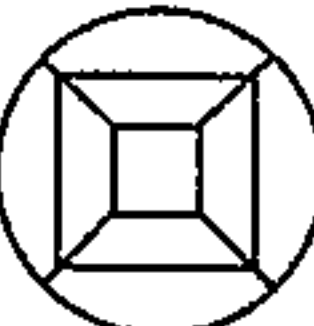
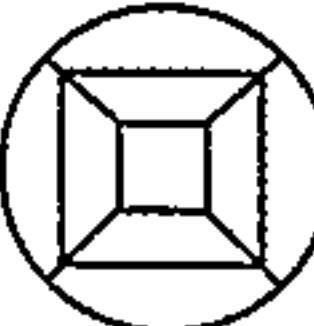
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Appendix E: Clinical examination chart

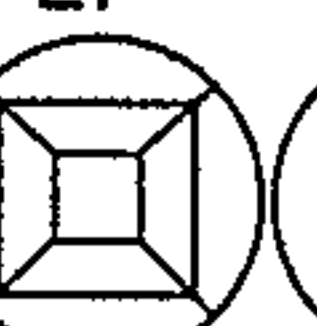
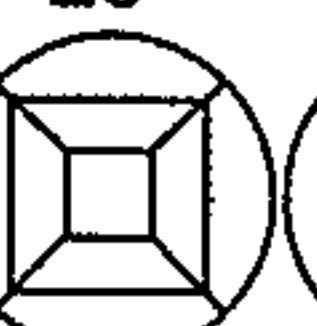
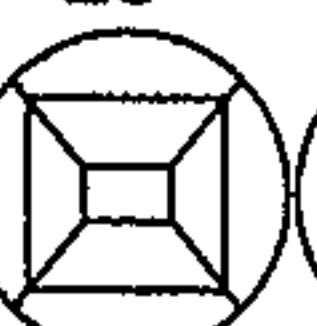
Hospital/Community Health Centre		M.R.N.	
Title		Family name	
Given names			
DOB	Sex	Consultant	Ward/Unit

Condition on examination

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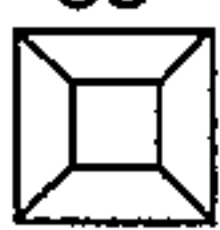


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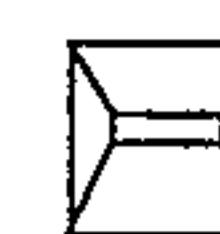
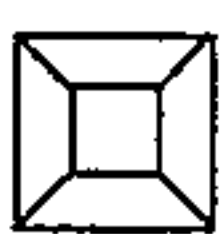
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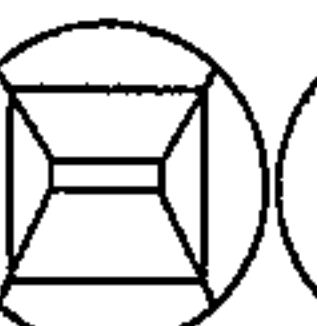
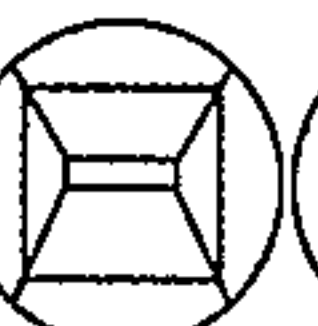
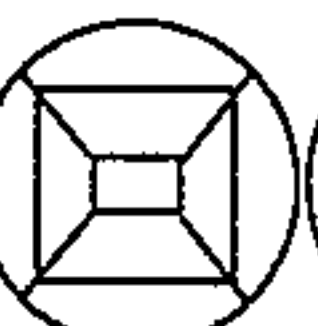
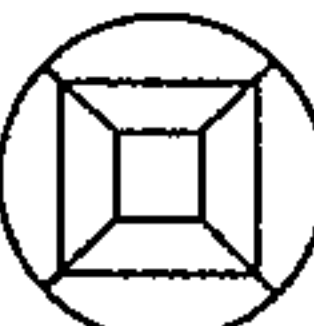
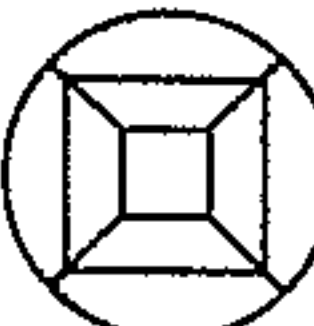
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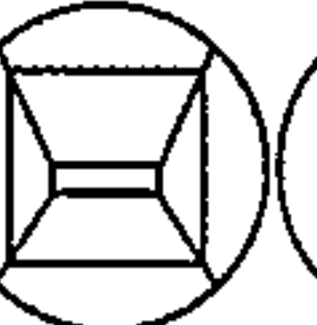
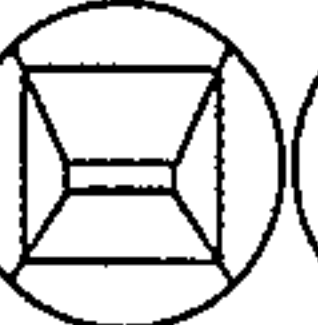
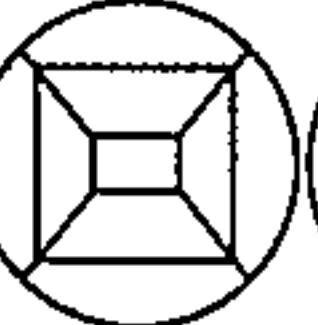
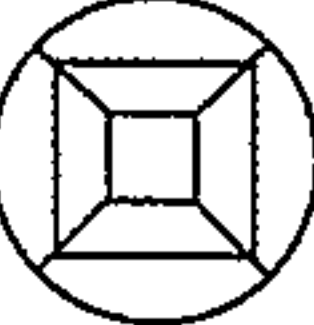
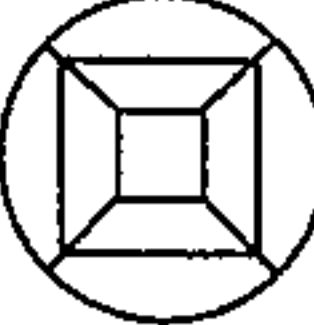
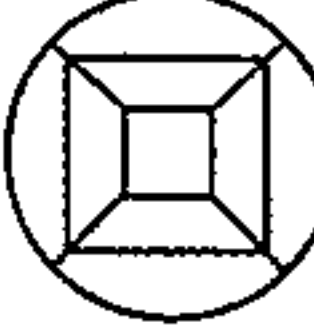
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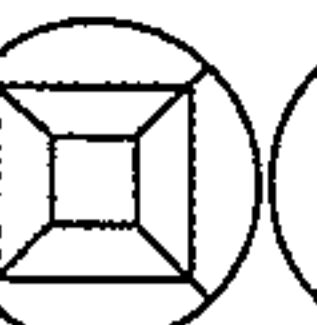
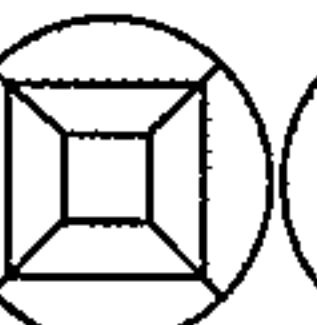
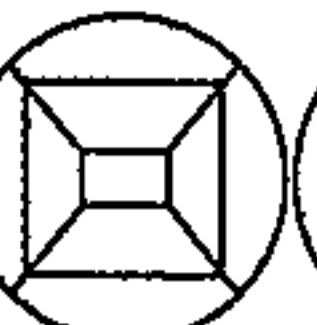
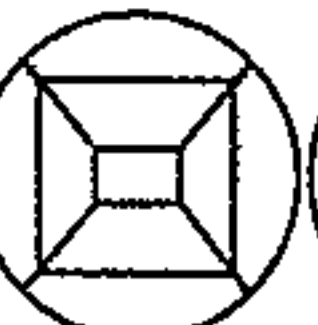
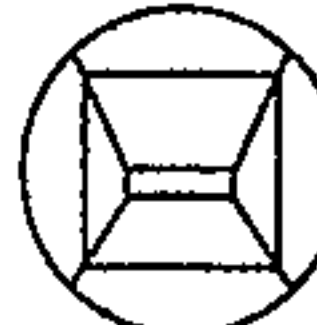
Exam

Treatment required

1817161514131211



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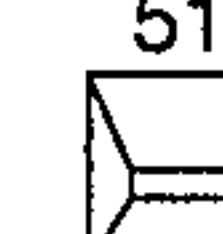


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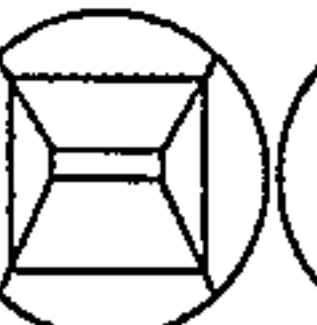
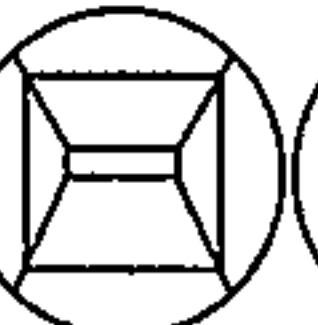
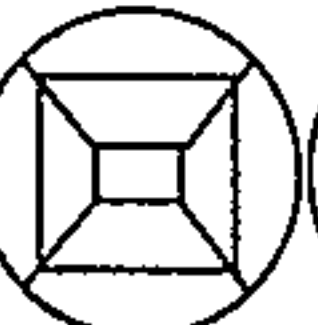
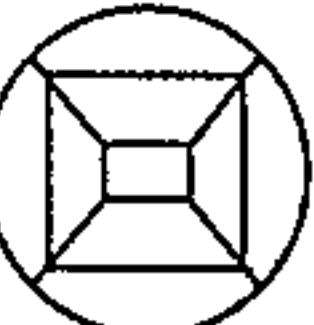
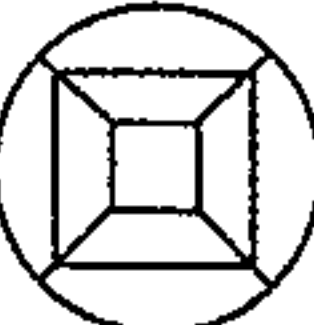
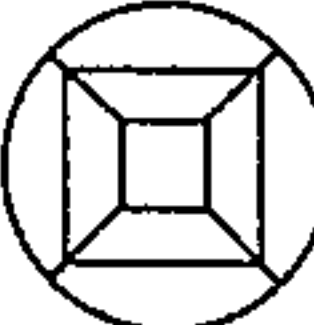
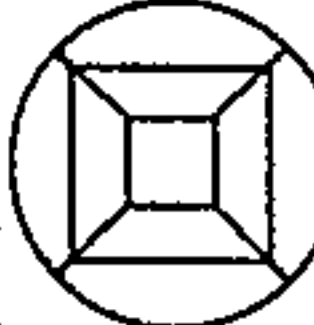
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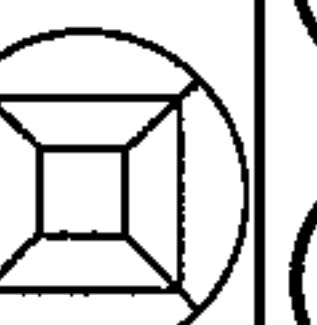
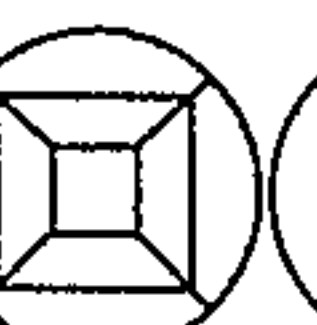
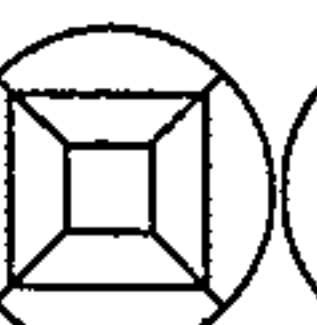
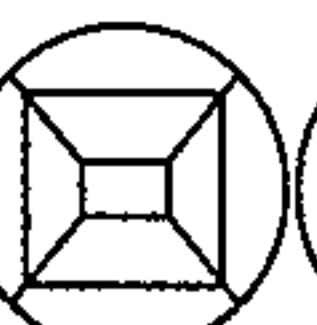
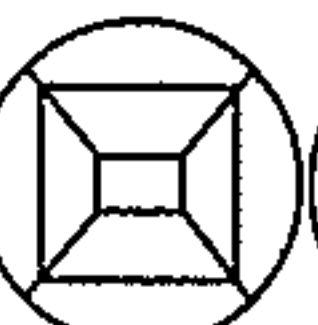
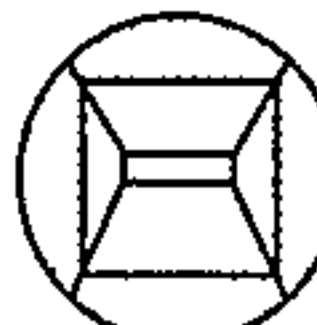
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Perio treatment required

Fluoride Tx

Fissure Tx

GI

Composite

Amalgam

Endo

Inlay/onlay

Crown/bridge/veneer

Extraction

Removable Pros

Tx Sequence 1.

2.

3.

4.

5.

6.

7.

8.

____ and I have discussed my/my child's _____
(Name of clinician) (Name of child)
present condition, the various ways in which it might be treated and the risks and complications which may occur. I have had the opportunity to ask questions. I request and consent to the treatment plan described above for me/my child.

Name of parent/guardian (print)

Signature of patient/parent/guardian

Signature of interpreter (if required)

Date / /

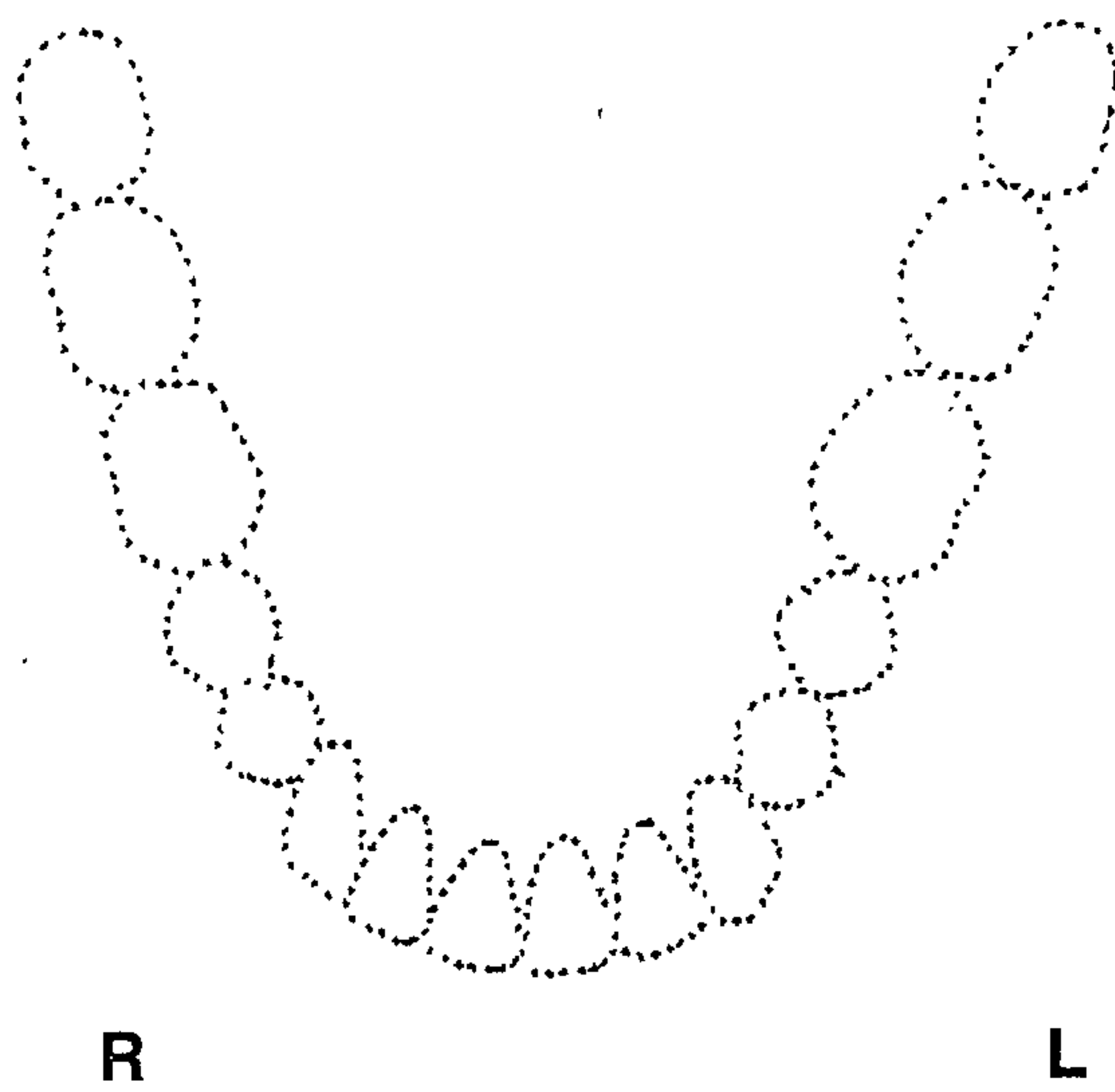
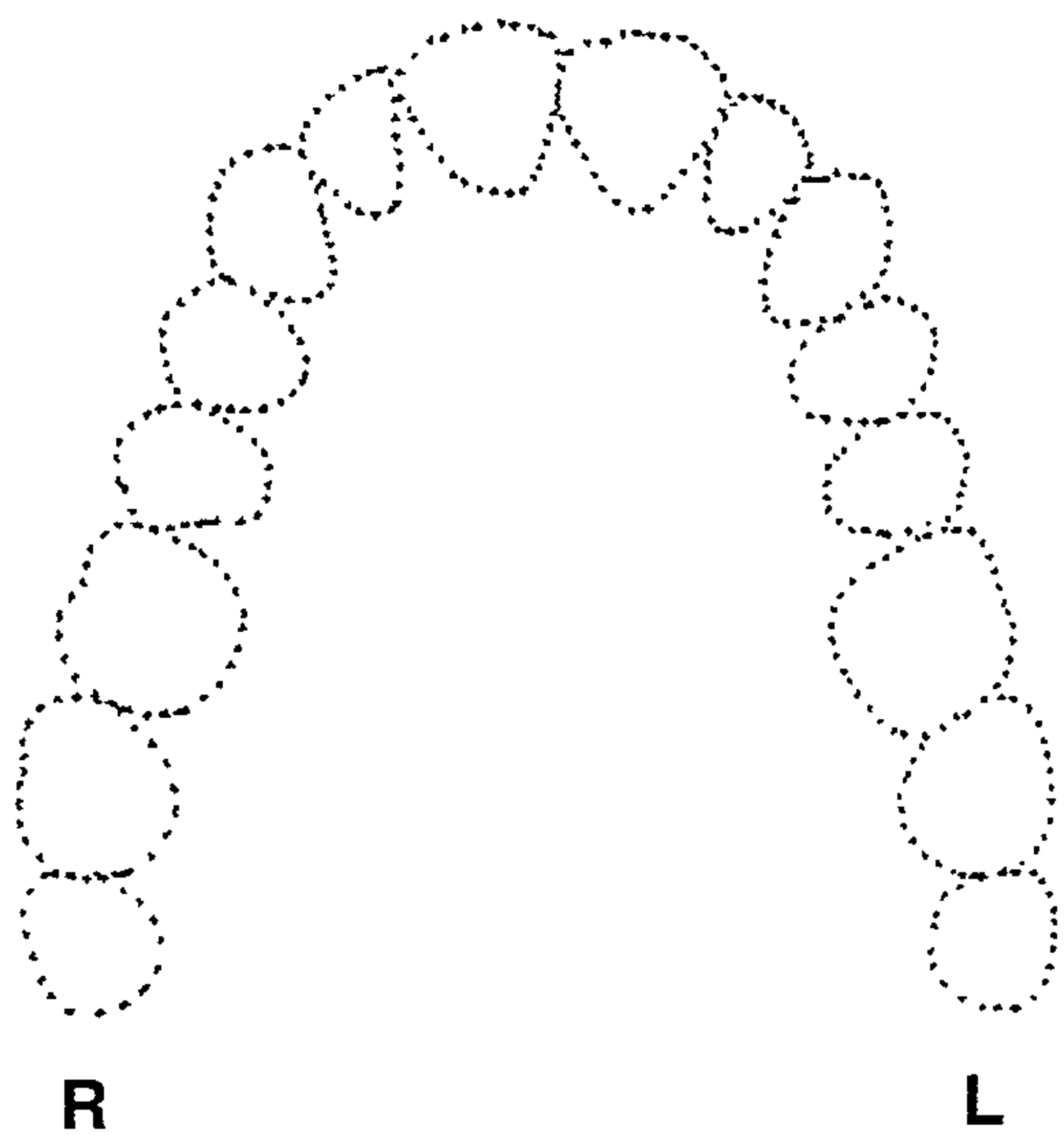
Clinician/student (print)

Staff signature

7/03

Treatment sequence (*continued*)

Appliance/denture/bridge design



Rests: _____

Retainers: _____

Retention areas: _____

Reciprocation: _____

Guide planes: _____

Connectors: _____

Artificial teeth: _____

Saddles: _____

Mouth preparations: _____

Shades/moulds: _____

Other instructions: _____

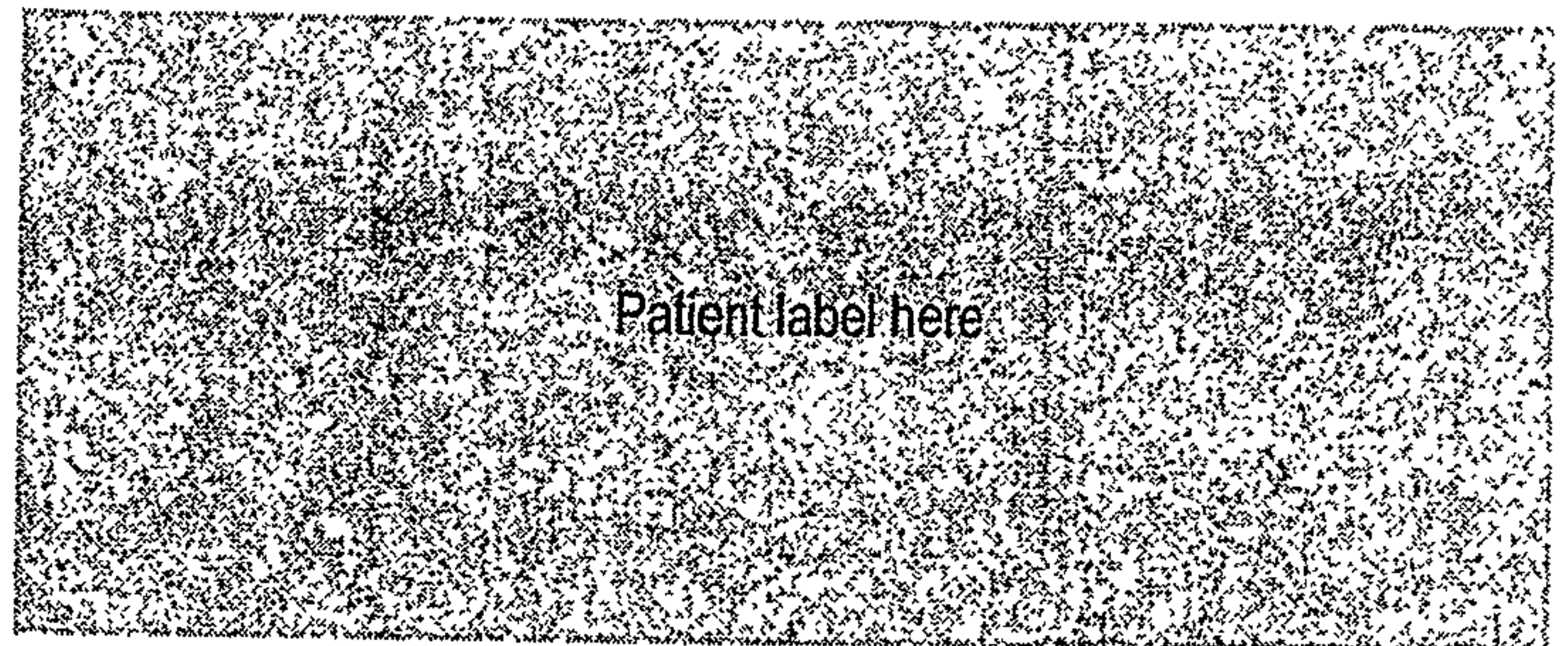
Date / / _____

Clinician/student (*print*)

Staff signature

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Appendix F: Usual 24 hour diet questionnaire



Patient label here

Usual 24 hour diet questionnaire
of between meal drinks and snacks

Date:
(dd / mm / yyyy)

NO	YES	FREQ*	Do you usually have anything as soon as you get up in the morning <i>before breakfast</i> ?
☐	☐	☐	Fruit juice
☐	☐	☐	Cordial
☐	☐	☐	Fizzy drinks (coke, lemonade, etc)
☐	☐	☐	Tea
☐	☐	☐	Coffee
☐	☐	☐	Other hot drink
☐	☐	☐	Other sugary food

How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐

NO	YES	FREQ*	Do you usually have anything to eat or drink <i>between breakfast and lunch</i> ?
☐	☐	☐	Fruit juice
☐	☐	☐	Cordial
☐	☐	☐	Fizzy drinks (coke, lemonade, etc)
☐	☐	☐	Tea
☐	☐	☐	Coffee
☐	☐	☐	Other hot drink
☐	☐	☐	Biscuit
☐	☐	☐	Cake
☐	☐	☐	Pastry
☐	☐	☐	Chocolate, sweets
☐	☐	☐	Other sugary food

How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐

NO	YES	FREQ*	Do you usually have anything to eat or drink <i>between lunch and dinner</i> ?
☐	☐	☐	Fruit juice
☐	☐	☐	Cordial
☐	☐	☐	Fizzy drinks (coke, lemonade, etc)
☐	☐	☐	Soft drinks (coke, lemonade, etc)
☐	☐	☐	Tea
☐	☐	☐	Coffee
☐	☐	☐	Other hot drink
☐	☐	☐	Biscuit
☐	☐	☐	Cake
☐	☐	☐	Pastry
☐	☐	☐	Chocolate, sweets
☐	☐	☐	Other sugary food

How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐

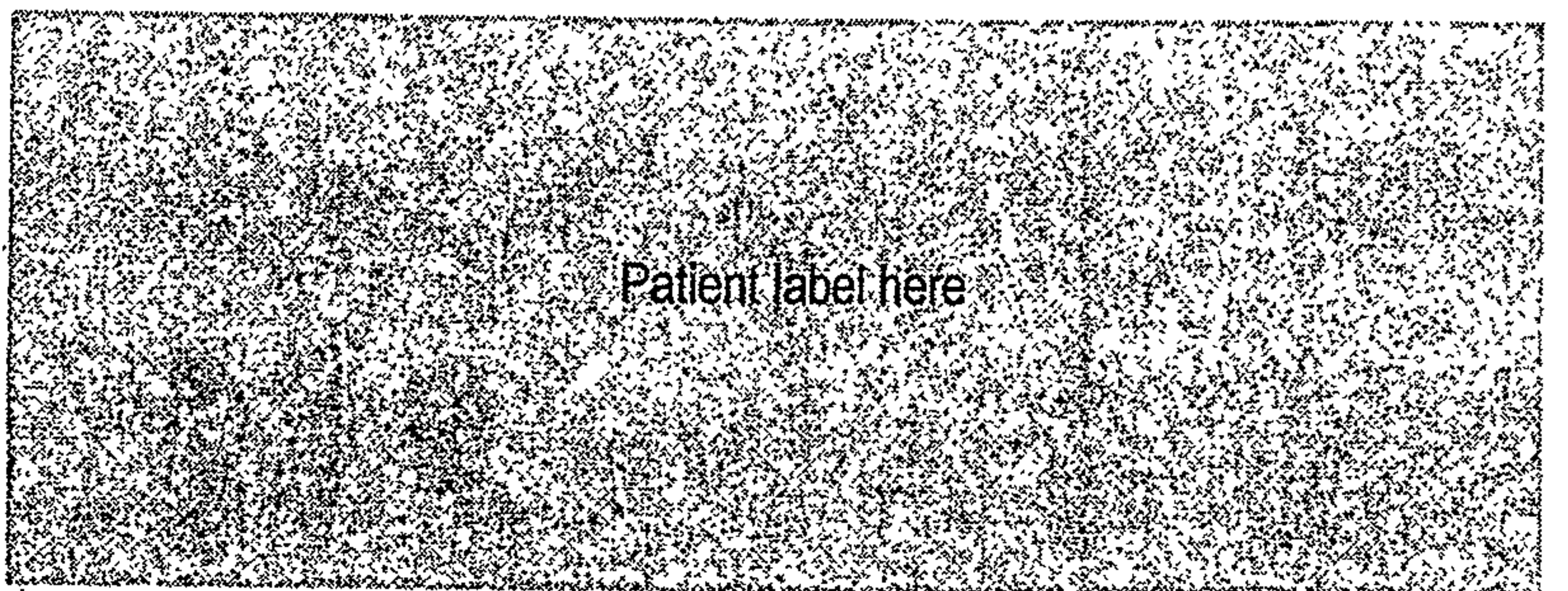
NO	YES	FREQ*	Do you usually have anything to eat or drink <i>after dinner</i> ?
☐	☐	☐	Fruit juice
☐	☐	☐	Cordial
☐	☐	☐	Fizzy drinks (coke, lemonade, etc)
☐	☐	☐	Tea
☐	☐	☐	Coffee
☐	☐	☐	Other hot drink
☐	☐	☐	Biscuit
☐	☐	☐	Cake
☐	☐	☐	Pastry
☐	☐	☐	Chocolate, sweets
☐	☐	☐	Other sugary food

How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐

NO	YES	FREQ*	Do you usually have anything to eat or drink <i>just before you go to bed or during the night</i> ?
☐	☐	☐	Fruit juice
☐	☐	☐	Cordial
☐	☐	☐	Fizzy drinks (coke, lemonade, etc)
☐	☐	☐	Tea
☐	☐	☐	Coffee
☐	☐	☐	Other hot drink
☐	☐	☐	Biscuit
☐	☐	☐	Cake
☐	☐	☐	Pastry
☐	☐	☐	Chocolate, sweets
☐	☐	☐	Other sugary food

How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐
How many spoons of sugar do you add ?	☐

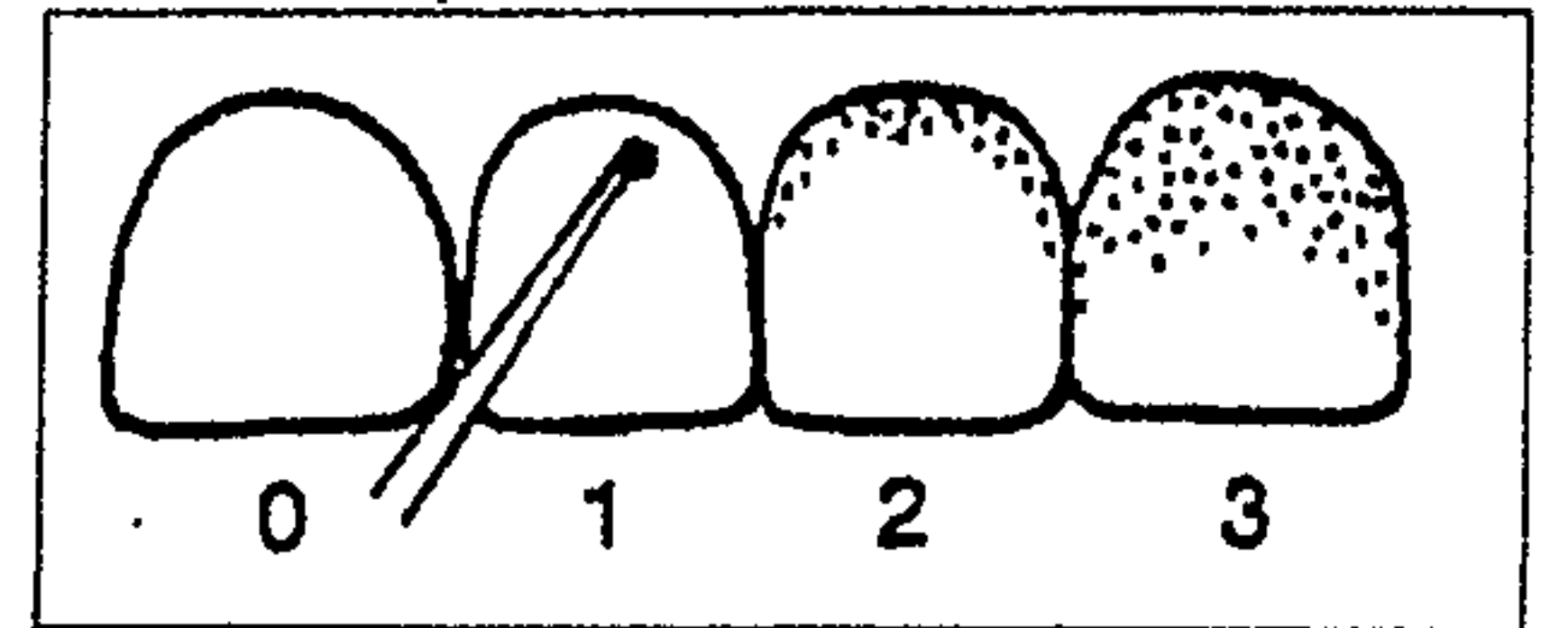
Appendix G: Plaque report form



PLAQUE REPORT FORM

Plaque Index (Silness & Loe)

- 3 = **thick** plaque is visible along gingival margin (no need to probe)
2 = plaque is **visible** along gingival margin, with or without air drying (no need to probe)
1 = following air drying, plaque is **not visible**, but **can be picked up** with an explorer
0 = following air drying, plaque is **not visible** and **cannot** be picked up with an explorer



- Notes: (1) If an index tooth is missing, score the nearest tooth in that sextant. If there are no teeth in the sextant, enter X.
(2) If the plaque thickness varies along the gingival margin of a surface, score according to the worst situation.
(3) The overall score is the sum of the 12 surface scores (minimum of 0 and maximum of 36)

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Date _____

Buccal
Surfaces

16	11	26
46	41	36

Lingual
Surfaces

16	11	26
46	41	36

Score _____

Appendix H: Bitewing radiographic assessment form

SYDNEY WEST
Area Health Service

**Bite-Wing
Radiographic
Assessment**

Patient label here

Key to Rating Caries

	Outer 1/2 of Enamel	1
	Inner 1/2 of Enamel	2
	Just into Dentine	3
	Outer 1/3 of Dentine	4
	Inner 2/3's of Dentine	5

Date of radiograph: / /
Read by: (Print name).....
Date of reading: / /
Signature:.....

	18	17	16	15	14	13	23	24	25	26	27	28
				55	54	53	63	64	65			
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
1												
2												
3												
4												
5												
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
				85	84	83	73	74	75			
	48	47	46	45	44	43	33	34	35	36	37	38

Other findings:-
e.g. bone loss,
unerupted teeth,
resorption, cysts, etc.

Key to Rating Caries

	Outer 1/2 of Enamel	1
	Inner 1/2 of Enamel	2
	Just into Dentine	3
	Outer 1/3 of Dentine	4
	Inner 2/3's of Dentine	5

Date of radiograph: / /
Read by: (Print name).....
Date of reading: / /
Signature:.....

	18	17	16	15	14	13	23	24	25	26	27	28
				55	54	53	63	64	65			
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
1												
2												
3												
4												
5												
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
				85	84	83	73	74	75			
	48	47	46	45	44	43	33	34	35	36	37	38

Other findings:-
e.g. bone loss,
unerupted teeth,
resorption, cysts, etc.

Key to Rating Caries

	Outer 1/2 of Enamel	1
	Inner 1/2 of Enamel	2
	Just into Dentine	3
	Outer 1/3 of Dentine	4
	Inner 2/3's of Dentine	5

Date of radiograph: / /
Read by: (Print name).....
Date of reading: / /
Signature:.....

	18	17	16	15	14	13	23	24	25	26	27	28
				55	54	53	63	64	65			
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
1												
2												
3												
4												
5												
	DOM	DOM	DOM	DOM	DOM	DOM	MOD	MOD	MOD	MOD	MOD	MOD
				85	84	83	73	74	75			
	48	47	46	45	44	43	33	34	35	36	37	38

Other findings:-
e.g. bone loss,
unerupted teeth,
resorption, cysts, etc.

BITE-WING RADIOGRAPHIC ASSESSMENT

Binding Margin - No Writing

Appendix I: Tooth decay pamphlet

Tooth Decay

Tooth decay, can be stopped, reversed, and prevented.
 Hidden decay can be seen on your x-rays.

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

What can your dentist do to stop decay ?

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

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

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

Your situation is shown on the chart below:

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

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

You are strongly recommended to
 attend your next appointment on

More information on tooth decay

What is tooth decay ?

Tooth decay (dental caries) is caused by **bacteria** in the **dental plaque** (a soft creamy coloured film) that builds up daily and sticks to teeth. These bacteria **ferment sugar** and produce acids which dissolve the hard tooth enamel and may cause a hole.

How is tooth decay prevented ?

Three ways to prevent decay:

- reduce **sugar** intake between meals
- remove **plaque** with your toothbrush
- drink water and use a **fluoride** toothpaste.

How is tooth decay managed ?

The management of decay involves (1) care by a dentist and (2) **home care**, of which home care is the **most important**.

Why should I avoid having holes and fillings ?

- when decay is cut out of a tooth, the tooth is usually weakened
- fillings need replacing from time to time
- replacement fillings are larger and weaken the tooth further
- fillings do not prevent decay from coming back

What are the benefits of dental care ?

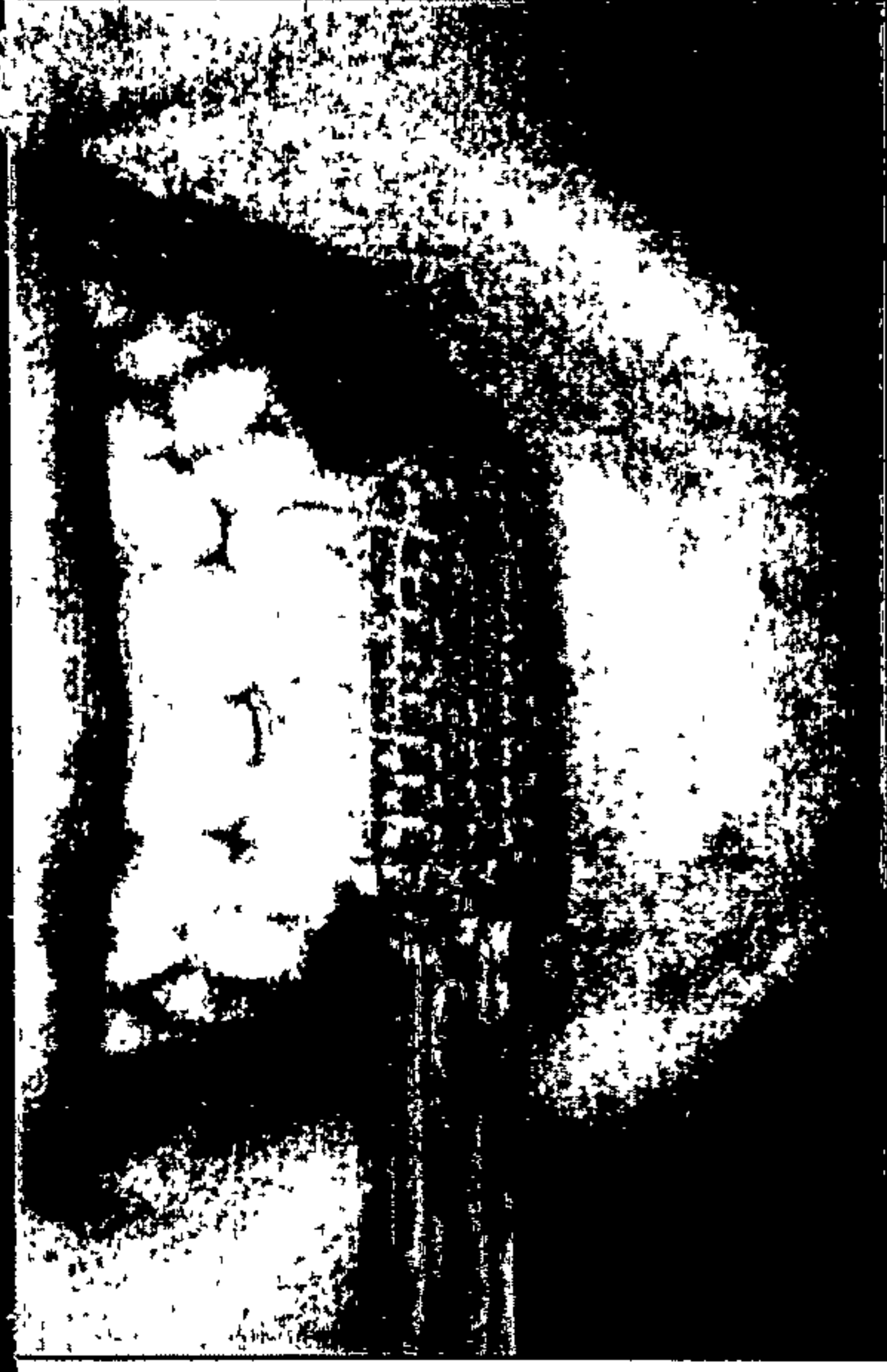
- decay is stopped without weakening the tooth
- your situation is monitored with follow-up x-rays
- your risk of new decay will be greatly reduced

You need an urgent dental appointment

- if your teeth become sensitive to cold foods or drinks
- if you get a hole in your tooth
- if a part of your tooth breaks off

Appendix J: Where do I brush pamphlet

Where do I brush?



Lip side of front teeth
(upper & lower)



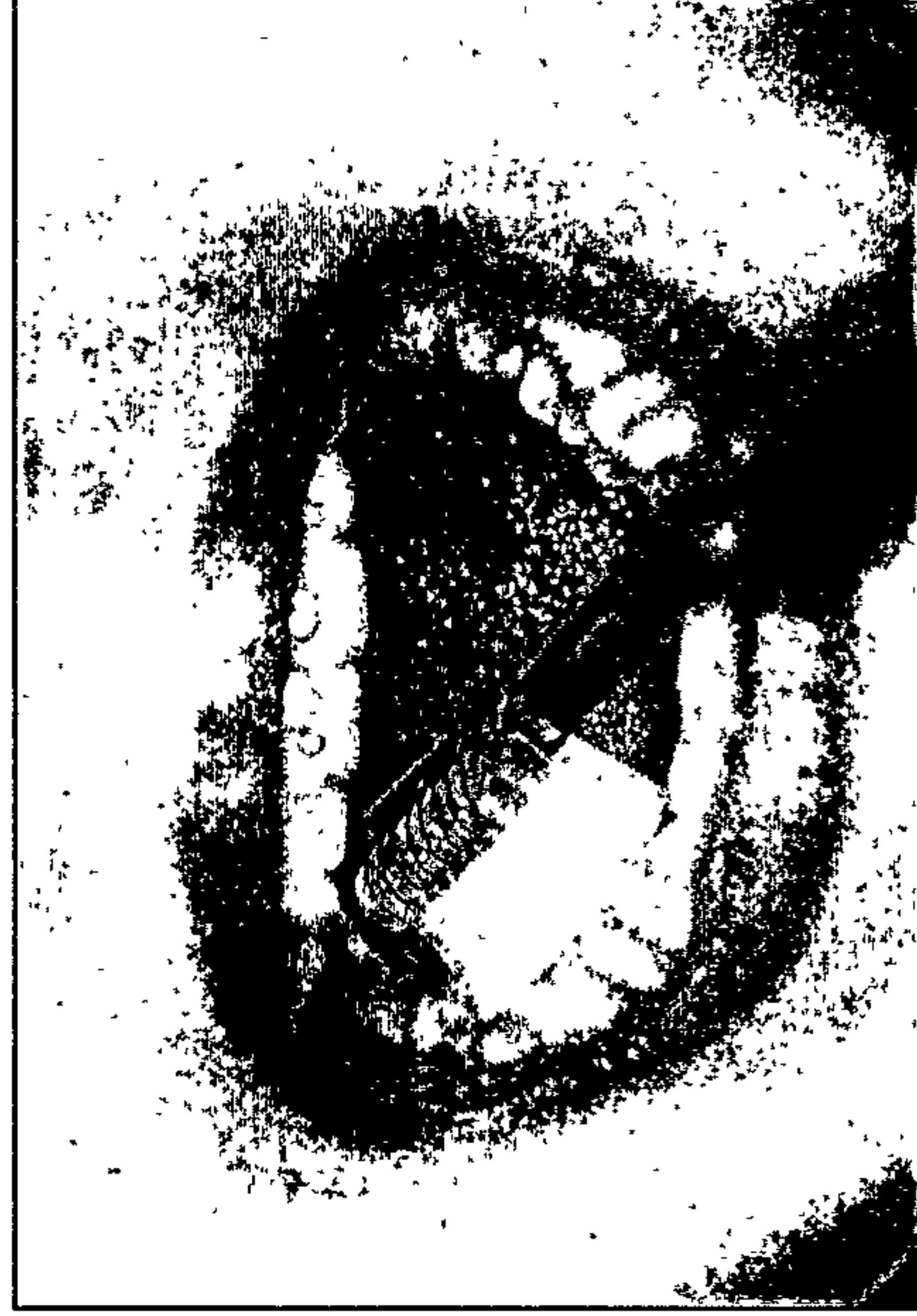
Cheek side of upper teeth
(right & left)



Cheek side of lower teeth
(right & left)



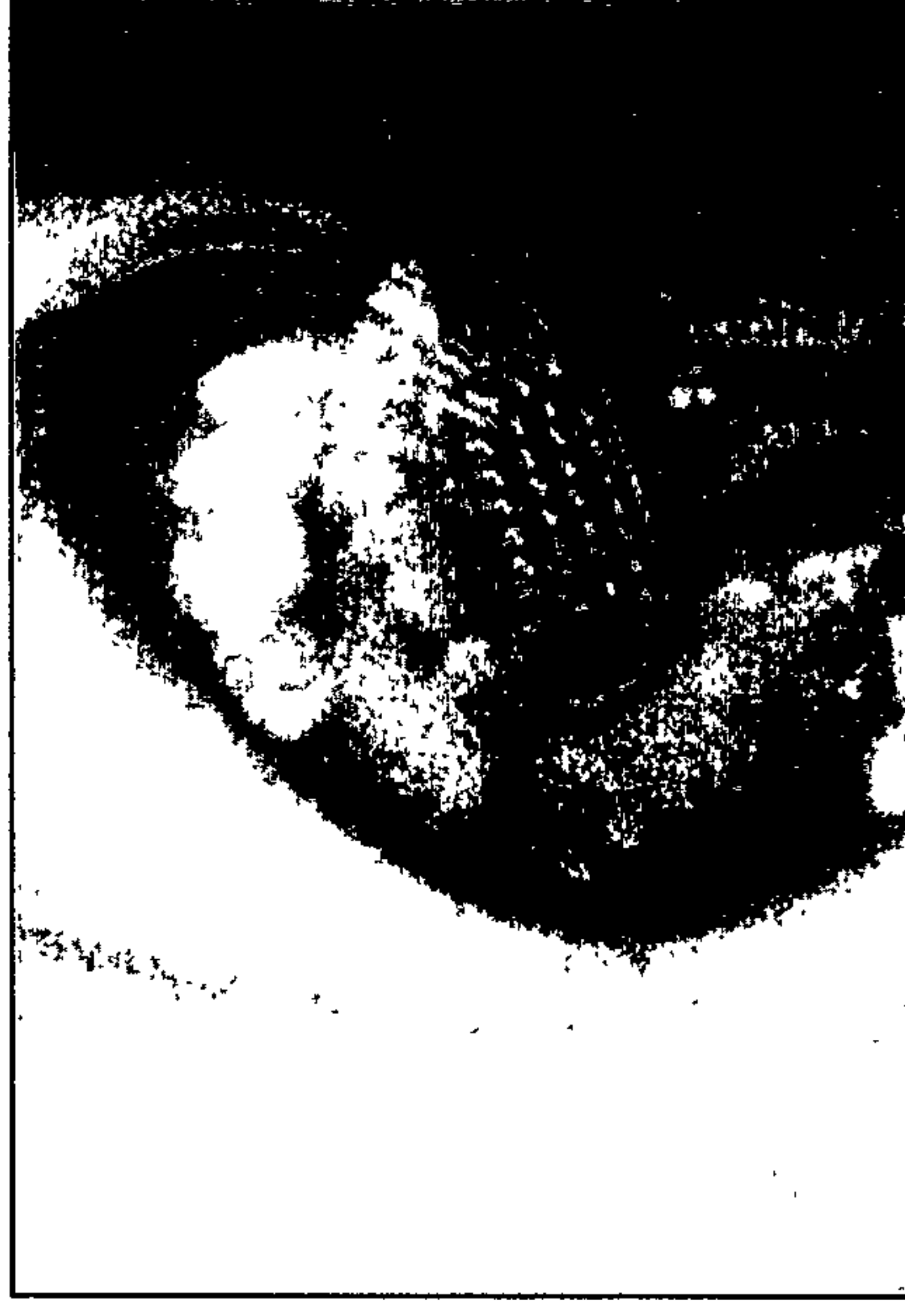
Biting surface of upper teeth
(right & left)



Biting surface of lower teeth
(right & left)



Behind front teeth
(upper & lower)



Tongue side of upper teeth
(right & left)



Tongue side of lower teeth
(right & left)

Courtesy: Afsaneh Pakdaman

Appendix K: Bitewings radiographs (CD)