Children's response to various local fluoride treatments

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The aim of the study was to evaluate children's response to four different gel tray systems and their preference to gel treatment twice a year versus fortnightly fluoride rinsing. For the study 91 children attending third grade (10 – 11 years) were divided into 3 groups and 119 children attending seventh grade (14 – 15 years) into 4 groups. The children were treated with a neutral 2 % sodium fluoride tixotropic gel by means of one of the following trays:

A. Air Cushion Fluoridator®
B. Centrays®
C. An individually constructed tray made of impression material (Citricon®)
D. An individually constructed tray made from soft acryllic.

After treatment the children's response toward the treatment was evaluated by means of interviews.

The majority of the children preferred gel tray treatment to fortnightly mouth rinsing ($p < 0.0003$). Disposible trays were less acceptable than the individually made trays or the Air Cushion Fluoridator®. However, all trays were tolerated for 15 minutes by all children. Cost analysis showed that the difference in expense using the various trays decreased as the number of treatments of the single individual increased.

Key-words: Gel trays; fluoride rinsing; cost-efficiency

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The caries preventive value of local fluoride application by painting or gel treatment has been extensively studied (6). When applied in groups with a high caries prevalence or in individuals with a high caries rate, these methods may result in considerable cariesreductions (3, 8, 10). From a cost benefit point of view painting with fluoride solutions appears less acceptable because of the professional time required for the application (4). By using fluoride gels the time required for treatment may be reduced. Furthermore, fluoride gels applied in trays may be administered by the patients themselves for home use.

The purpose of the present study was to evaluate children's response to various local fluoride treatment

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MATERIAL AND METHODS

Children attending third and seventh grade in public schools in the city of Randers were randomly assigned to three, respectively four groups (Table 1).

A tixotropic 2% sodium fluoride gel was used with all types of trays.

All gel tray applications were carried out by one of the authors (J.B.). The children were placed in identical sitting positions and told to keep the tray in the mouth for 15 minutes, if possible. The sequence of the application of the four different tray systems (Fig. 1) were randomized in advance.

The operator classified the behaviour of the children during the treatment as follows:

1. Treatment could not be carried out.
2. Signs of disliking the treatment were clearly shown by the child. May afterwards express that he did not like the treatment.
3. The child showed signs of not liking the treatment. May after the treatment express slight disapprovement.
4. No signs of diskliking or complaints were noted.

Time used for preparing and inserting the trays was registered. The time used for the construction of tray III and IV had previously been registered. Finally, the time used for cleaning and storing the various trays was noted.

Following the gel application, each child was asked the following questions by an assistant in an adjacent room:

A. How did you like the treatment?
B. What was the taste like while you had the tray in your mouth?
C. What was it like afterwards?
D. Would you prefer this treatment twice a year to fortnightly fluoride rinsing?

The children answered questions A, B, and C using the scale shown in Fig. 2.

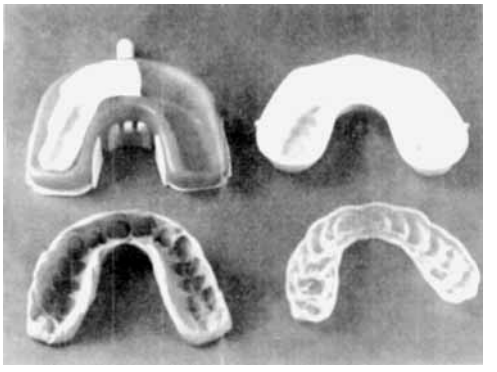

Fig. 1. I. Upper left: Ion Cushion®. II. Upper right: Centray®. III. Lower left: Tray made directly in the mouth using elastic impression material (Citricon®). IV. A soft acryllic tray constructed in dental laboratory (Biostar®).

Table 1. *Number of children and fluoride gel tray systems used*

	Tray system	3rd grade N	7th grade N
I	Ion cushion®	31	31
II	Centray®	31	30
III	Individual tray A	29	30
IV	Individual tray B	–	28

Statistical comparison between various groups was carried out by means of the Mann-Whitney U test (15).

RESULTS

The result of the study can be summarized as follows:

1. All children kept all types of trays in their mouths for 15 minutes.
2. The operator evaluated tray I as better than tray II ($P < 5\%$) as judged from

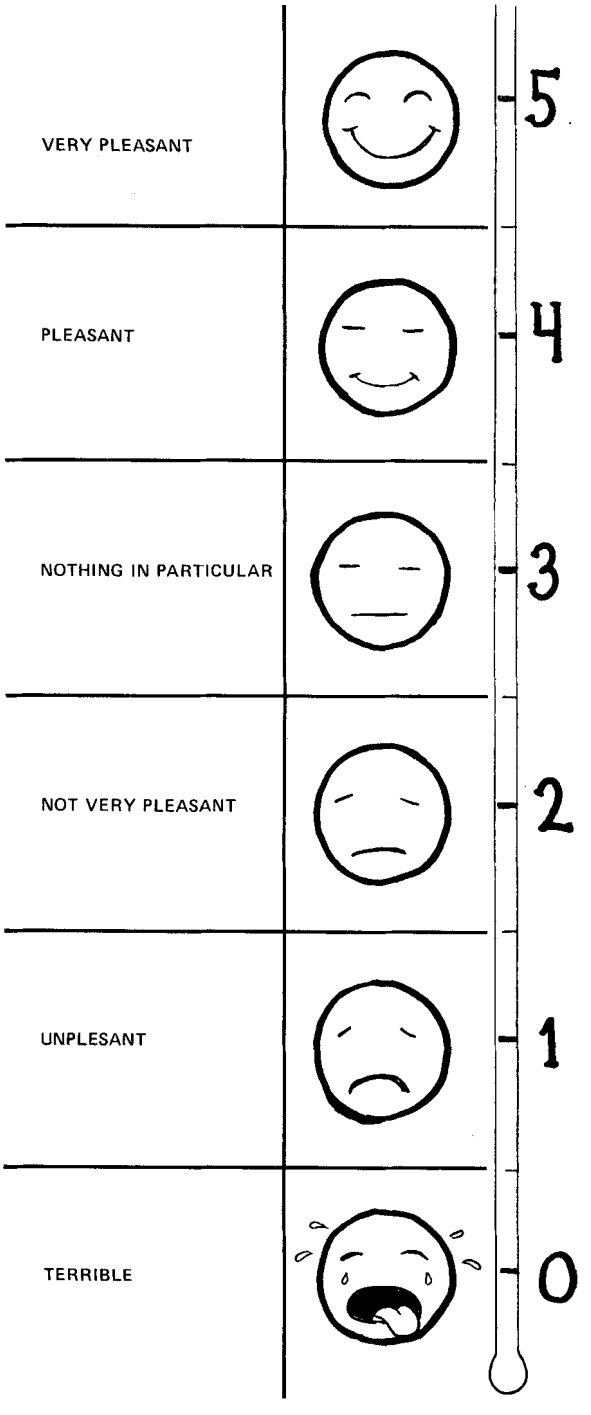

Fig. 2. Scale in six grades running from strongly disliking to unquestionable approval.

the children's behaviour. No other differences were found (Table 2).

3. The children in the third grade were more positive towards the treatment judging from question A and B than were the children in the seventh grade (Table 3) ($p < 5\%$). Comparisons were therefore carried out separately for the two age groups.
4. Intra group statistical comparisons of the children's answers to the question: «How did you like the treatment?» showed that in the third grade, tray I was more acceptable than tray II ($P < 1\%$), and tray III was more acceptable than tray II ($P < 5\%$). In the seventh grade tray IV was more acceptable than tray II ($P < 1\%$), and tray III was more acceptable than tray II ($P < 5\%$) (Table 3).
5. The children's response to the question: «What was the taste like while you had the tray in your mouth?» showed that tray I was evaluated significantly better than tray II ($P < 1\%$) in the third grade. In the seventh grade tray I was significantly better than trays II and III ($P < 1\%$) while tray IV was significantly better than trays II and III ($P < 5\%$) (Table 3).
6. The children's response to the question: «What was it like afterwards?» showed no significant difference between the various trays (Table 3).
7. The majority of the children (82%) preferred fluoride tray treatment twice a year to fortnightly fluoride rinsing (Table 4).
8. The average time used in the clinic for inserting, cleaning, and storing amounted to 7 minutes for tray I, 2 minutes for tray II, and 3 minutes for tray III and IV. The construction time for tray III was 6 minutes. Impression taking for tray IV took 12 minutes and the construction time in the laboratory was 20 minutes.
9. Estimating the expense in connection with the gel tray methods the follow-

Table 2. *Distribution of children according to the operators' evaluation of children's response*

Operators' evaluation / Tray	3rd grade 1	2	3	4	7th grade 1	2	3	4
I	0	2	6	23	0	1	5	25
II	0	4	15	12	0	3	6	21
III	0	3	9	17	0	1	11	18
IV	–	–	–	–	0	1	5	22

Table 3. *Distribution of children according to their response in the third and seventh grade*

Question	Tray	3rd grade Scale values 0	1	2	3	4	5	7th grade Scale values 0	1	2	3	4	5
A. How did you like the treatment?	I	1	1	1	3	12	13	0	1	11	5	9	5
	II	2	3	6	5	9	6	3	3	8	6	9	1
	III	2	1	3	4	7	12	1	5	7	6	9	2
	IV	–	–	–	–	–	–	0	1	4	9	8	6
B. What was the taste like while you had the tray in your mouth?	I	1	2	2	4	7	15	0	2	5	6	9	9
	II	2	5	6	5	7	6	2	6	8	2	10	2
	III	3	3	3	3	7	10	2	4	5	10	7	2
	IV	–	–	–	–	–	–	1	1	6	5	11	4
C. What was it like afterwards?	I	3	3	6	1	5	13	0	5	9	7	6	4
	II	2	2	3	9	5	10	3	2	7	2	5	11
	III	2	1	4	6	5	11	4	1	6	4	5	10
	IV	–	–	–	–	–	–	0	4	9	3	6	6

ing was assumed: All re-usable intra oral tray elements were assumed to have a usefull duration of 500 applications.

The purchase prices of material used for each treatment were based on 1979 prices, and are given in Danish currency.

In Table 5 the cost of a variable number of applications for the single individual using each of the four trays is calculated.

DISCUSSION

Choice of gel trays for the study

Custom fitted trays or individually constructed trays were chosen for the study if fulfilling the following criteria:

a. The trays must distribute the gel uniformly on the surfaces of the teeth.
b. The amount of gel necessary for the application should be no more than 2 ml 2 % sodium fluoride gel (12).

Table 4. *Distribution of children according to their preference to fortnightly fluoride rinsings versus half yearly gel treatment*

	Grade			
	3		7	
Group	Rinsing	tray	Rinsing	tray
I	7	25	1	30
II	14	16	4	26
III	5	24	6	24
IV			1	27
I–IV	26	65	12	107

Foam plast trays require too much gel because a considerable amount of the gel will be absorbed in the foam plast.

c. The material used for the tray construction must be elastic in order to support the flow of a tixotropic gel into the proximal spaces. Wax trays appear not to be able to press the tixotropic gel into the proximal spaces.

Choice of application time

It was expected that a prolonged application time would accentuate differences in the acceptability of the trays. It was emphasized to the children that they could remove the trays as soon as they liked. If a tray was particularly uncomfortable its removal after a few minutes would reveal this.

Choice of method for inquieries

Face expressions seem to be almost universally understood (1, 5). The figure scale was combined with an analogue scale which has been used in measuring the pain sensation (7). The operator's opinion is likely to influence the children's answers. For this reason the children were inquired by an assistant sitting in a room next to the clinic not knowing the kind of treatment the child received.

Table 5. *Cost per application (D.Kr.) using a tray for a variable number of applications for the individual patient. It is assumed that tray I will be used 500 times*

	Tray			
Costs	I	II	III	IV
Fluoride gel	0.20	0.20	0.20	0.20
Purchase or construction	1.00		10.00	100.00
Disposable part	1.00	5.00		
Labour costs Auxillary* (Dentist)	5.8 (17,5)	1.6 (5,0)	2.5 (7,5)	2.5. (7.5)
Price 1 application	8.0 (19.7)	6.8 (10.2)	12.7(17.7)	102.7(107.7)
Price 10 applications	8.0 (19.7)	6.8 (10.2)	3.5 (8.5)	12.5 (17.7)
Price 25 applications	8.0 (19.7)	6.8 (10.2)	2.9 (7.9)	6.7 (11.7)

* Auxillary = 50 kr. h^{-1}
Dentist = 150 kr. h^{-1}

Discussion of results and the implications

Only few studies on the acceptability of gel tray systems have been carried out (2, 9, 13, 14).

In previous studies the patients' reaction to a tray system and the specific gel delivered with that system have been evaluated (2, 14). As the viscocity and taste of the gel may be important for the patients' acceptance it seems more reasonable to use one gel system for all types of trays. Thus, a direct comparison between this study and previous studies is difficult. At present no studies have compared the caries prophylactic effect of different topical gel application methods. The final decision on tray type selection must therefore be based on cost estimation and the children's reaction to the various treatments.

Whenever a new preventive agent becomes available, it is necessary to evaluate its efficiency, and equally necessary to evaluate its usefulness and practicability.

As judged from the problems which the Danish school dental service has faced in older grades when applying fortnightly fluoride rinsing, the acceptability of the method is important.

Gel tray treatments have some advantages in this respect:

1. The application can be carried out in clinics or at home, thus leaving the teaching and teachers undisturbed.
2. Supposing the treatment is carried out after routine dental check-up or operative treatment the time required may be minimal – in particular if a tray system can be applied by the children themselves.
3. The treatment can be integrated with hygiene instruction. It seems worthwhile to try to combine instruction of teenage children in the use of dental floss in combination with self-application of a gel tray system.

In this study fluoride gel treatment was well accepted by the children and from this point of view the method offers an acceptable alternative to other local fluoride treatments.

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