

Monitoring versus contingency contracting to increase children's compliance with home fluoride mouthrinsing

M.H. Cipes, DMD, MSD M. Miraglia, MPH

Abstract

This study repeated an experimental test of the role of the parent in children's compliance with a home fluoride mouthrinse program. One hundred and twenty suburban and 104 inner-city children were asked to use an acidulated fluoride mouthrinse daily for 14 weeks and to return at 2-week intervals to return bottles and pick up a fresh supply of mouthrinse. Children were assigned randomly to 1 of 4 experimental conditions as follows: (1) control group, (2) self-monitoring group, (3) contingency contracting, and (4) monitoring and contingency contracting. Compliance was measured in 3 ways: by the total number of doses of mouthrinse used over the 14-week period, by the number of bottles returned, and by the number of doses of mouthrinse used per bottle.

The results, analyzed by ANOVA, revealed that children who monitored their mouthrinsing used significantly more doses of mouthrinse, returned significantly more bottles, and used significantly more doses per bottle. Contingency contracting between parents and children had a less significant negative effect on compliance decreasing the number of doses of mouthrinse measured by decreasing the number of bottles returned. Suburban children returned significantly more bottles and used significantly more doses of mouthrinse than did inner-city children.

This study extends earlier findings by including inner-city children and improves on the previous work by more clearly defining the parental intervention and randomly assigning subjects to experimental condition.

This paper reports the results of the second of two experiments designed to test the impact of behavioral interventions on second grade children's compliance with simple preventive regimens. The first experiment [Pediatr Dent 7:111-18, 1985] which tested self management vs parental involvement showed that children's compliance could be increased by the sys-

tematic application of behavioral principles. However, the precise impact of self management vs parental involvement on children's compliance was difficult to discern. This failure to distinguish between experimental groups may have been due to the complexity of the interventions and the difficulty of separating the relative contribution of parent vs child to compliance in this young age group.

This experiment expands on the results of the previous work by: clearly identifying monitoring as the common element in self-management and parental involvement, by more clearly defining the experimental parental role, by randomly assigning subjects to experimental conditions within each school, by including inner-city as well as suburban subjects, and by extending the program from 10 to 14 weeks.

The first method tested in this experiment was monitoring, the common element in the 3 experimental groups with the highest compliance in the first experiment.¹ Monitoring has been suggested to be effective in increasing compliance with dental preventive measures²⁻⁴ as well as other preventive health measures.⁵⁻⁷

The second method tested was contingency contracting between parents and children. Contingency contracting is a widely used strategy for involving parents in modifying their children's behavior.⁸⁻¹⁵ This contingency management plan is a written social contract between parent and child. The child is an active participant in formulating the contract and providing input as to desirable outcomes. Such contracts spell out the relationship between the target behavior (i.e., mouthrinsing) and its consequences.

Methods

Procedures

The study sample consisted of second graders at

one large inner-city school (N = 104) and 1 of 3 suburban elementary schools (N = 120). The suburban community chosen was different from the suburban community which participated in the first experiment.

As in the previous study, prior to the onset of the project, parents of all second graders were mailed a questionnaire assessing their prior experiences, practices, dental health beliefs, health locus of control, and demographic data. This questionnaire was an abbreviated version of the one used in previous work. A parallel, structured questionnaire was administered verbally to the children in school. Follow-up phone interviews were conducted on parents who failed to return their questionnaires to minimize missing data. Both parents' and children's questionnaires and interviews were available in Spanish as needed for a small subsample of the inner-city families.

All children were shown the informational slide show, and asked to volunteer and receive parental permission to participate as before. Participants were expected to use an acidulated fluoride mouthrinse daily at home for 14 weeks and to return at 2-week intervals to pick up a fresh supply. Children were mailed reminders of their appointments and rewarded with inexpensive toys for keeping these appointments.

Fourteen doses of mouthrinse were dispensed at each appointment in a dispensing bottle with a time delay which prevented the release of more than a single dose every 8-14 hours. This bottle is described and illustrated elsewhere and contains a number of characteristics to discourage "cheating."¹

Experimental Design

The 224 subject pairs of parents and children who participated in this experiment were divided randomly in a 2 × 2 factorial design into 4 groups: control group, monitoring group, contingency contracting group, and monitoring/contingency contracting group. Since subject assignment was random, experimental materials were visually similar and taken home by the children in sealed envelopes to minimize comparisons among groups. The similarity of the materials is demonstrated in Figure 1. A brief description of the groups follows:

1. *Control Group*: In addition to the procedures common to all groups, such as the introductory slide show, reminders of appointments and rewards for returning bottles, children in this group received a colorful poster and loose stickers with their mouthrinse supply and told that they could do whatever they wanted to with the poster and that it was to "play with."

2. *Monitoring Group*: In addition to the common

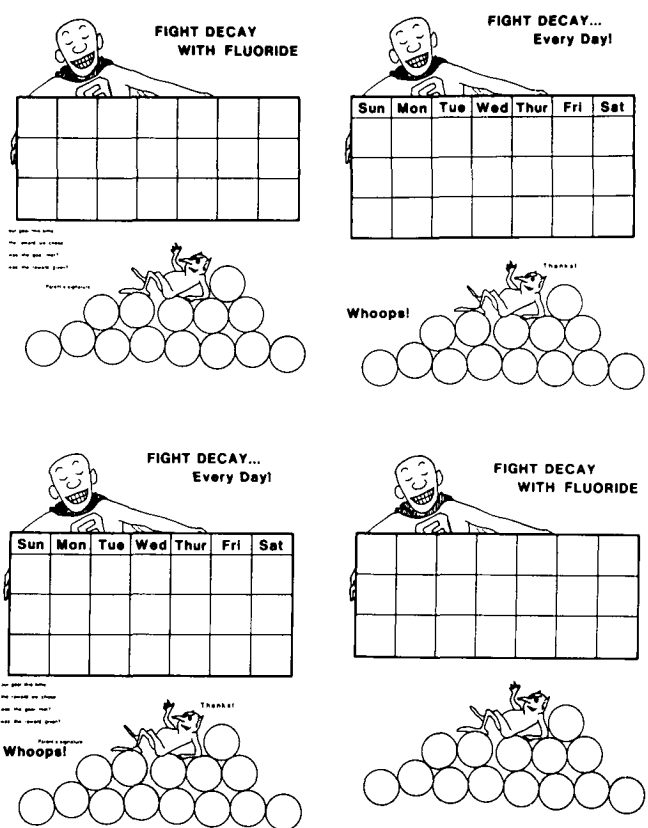


FIG 1. The similarity of the experimental materials is illustrated. All materials were sealed in a manilla envelope prior to being taken back to the classroom and then home.

- UL: Children in the Control Group received a poster and loose smile stickers to play with.
- UR: Children in the Monitoring Group received a calendar and smile stickers to record their usage (top) or their forgetting to use the mouthrinse (bottom).
- LL: Children in the Contingency Contracting Group received a poster, with a contracting sticker for their parents to fill out and loose smile stickers to play with.
- LR: Children in the Monitoring/Contingency Contracting Group received a calendar with a contracting sticker for their parents to fill out and smile stickers to record their usage (top) or their forgetting to use the mouthrinse (bottom).

procedures, children in this group received a colorful calendar with stickers. They were instructed to place a sticker on each day of the week that they remembered to use their mouthrinse and a sticker on the "Whoops" section of the poster on the days that they forgot.

3. *Contingency Contracting*: Children in this group received the same poster and stickers to play with as the Children in Group I. In addition, they participated in contingency contracting with their parents. Parents of children in this group were mailed a letter asking them to help their child learn this new habit by rewarding their mouthrinse use and a set of instructions, consisting of specific steps to follow to set

up a "contingency contract" with their child. Parents were asked to set a specific number of doses with their child as a goal. They were asked to choose a reward, (i.e., time, activity, or material) together for meeting the goal, and to reward their child contingent on the child's meeting the agreed upon goal. As evidence of the contract's existence and fulfillment, parents were asked to fill out and sign a sticker on the child's poster which asked what the goal was, what the reward was, whether the goal was met, and whether the reward was given. If the sticker was filled out improperly, a phone follow up was done to assure that the procedure was understood. The letter, steps to follow, and use of the contracting sticker are illustrated in Figure 2.

4. *Monitoring/Contingency Contracting*: Children received calendars with stickers and monitored their mouthrinse usage as in Group 2 in addition to contracting as in Group 3.

Compliance

Compliance with the program was measured in 3 ways: the number of doses of mouthrinse used as

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Dear Parent,

This program is to help your child learn to use fluoride mouthrinse. As the parent, you are the most important person in helping your child learn new habits. I will be giving your child a small prize for returning the mouthrinse bottle, but rewards from parents work even better. You can help your child learn to use mouthrinse by rewarding him or her for using it.

Every 2 weeks for the next 14 weeks, your child will bring home a new poster and mouthrinse bottle from school. Each time your child brings home a new poster, help your child by following the steps on the next page.

I hope you enjoy doing this with your child.

Sincerely,

Monica H Cipes

Monica H. Cipes, D.M.D.
Dept. of Behavioral Sciences
and Community Health

FARMINGTON, CONNECTICUT 06032

FIG 2. Parents of children in the 2 experimental groups who were asked to participate in contingency contracts were sent an introductory letter.

measured from the dispensing bottles and summed over the 14-week period, the number of bottles returned, and the average number of doses used per bottle (total doses/total bottles returned).

Results

A total of 224 of 283 eligible students agreed to participate. Only the effect of experimental condition on compliance is reported since analysis of the predictive value of the questionnaire measures has not been completed for this experiment.

Table 1 presents the means for the 3 compliance measures by experimental group and school location (inner city vs suburban). As can be seen from this table, overall compliance was high, the average number of doses used was 66.9 (68.3%), the average number of bottles returned was 6 of 7 bottles, and the average use per bottle was 10.8 of the 14 doses (77%).

Table 2 presents the results of the analyses of variance for the compliance measures by experimental condition and school location. As can be seen, monitoring had a significant positive effect on the number of doses used ($p < .01$), the number of bottles returned ($p < .05$), and the number of doses used per bottle ($p < .05$). Thus, the positive effect on dose usage was not an artifact caused only by increased bottle return (resulting in a larger number of doses measured from the bottles), but an actual increase in usage per bottle.

Contingency contracting depressed compliance in terms of the number of doses used ($p < .05$) and the number of bottles returned ($p < .01$), but not doses per bottle. The fact that contracting did not affect this last compliance measure again suggests that the depression of the total number of doses used may have been due to the failure to return bottles (i.e., inability to count those doses).

Suburban children used significantly more doses of mouthrinse ($p < .001$) and returned significantly more bottles ($p < .001$) than did their inner-city counterparts. However, the average number of doses used per bottle did not vary by school location suggesting that failure to return bottles was responsible for the apparent depression of usage.

For data analysis purposes subject pairs in the contracting groups were dichotomized into those who understood contracting vs those who did not. Those subject pairs who successfully completed at least 1 contracting agreement were defined as understanding contracting. Of the 121 children in Groups 3 and 4, 84 successfully participated in contingency contracting with their parents. Chi square analysis of the difference between inner-city and suburban participants in these groups indicated that a larger number of suburban parent-child pairs successfully com-

TABLE 1. Number of Doses of Mouthrinse Used, Bottles Returned, and Doses Used per Bottle

	<u>Group 1</u> (control)	<u>Group 2</u> (self-monitoring)	<u>Group 3</u> (contingency contracting)	<u>Group 4</u> (self-monitoring and contingency contracting)	Total
Number of doses used					
Total x	66.77(56)	72.98(47)	59.06(54)	69.04(67)	66.89(224)
Suburban x	71.45(29)	78.65(23)	64.48(31)	73.32(37)	71.61(120)
Inner-City x	61.74(27)	67.54(24)	51.74(23)	63.77(30)	61.45(104)
Number of bottles returned					
Total x	6.23(56)	6.45(47)	5.30(54)	6.12(67)	6.02(224)
Suburban x	6.59(29)	6.61(23)	5.74(31)	6.46(37)	6.33(120)
Inner-City x	5.85(27)	6.29(24)	4.70(23)	5.70(30)	5.65(104)
Number of doses used per bottle					
Total x	10.43(56)	11.01(47)	10.38(54)	11.21(67)	10.77(224)
Suburban x	10.79(29)	11.35(23)	10.34(31)	11.28(37)	10.93(120)
Inner-City x	10.04(27)	10.69(24)	10.45(23)	11.12(30)	10.59(104)

() = N.

TABLE 2. Analysis of Variance Summary for Number of Doses of Mouthrinse Used, Bottles Returned, and Doses Used per Bottle

Source	Number of Doses Used			Number of Bottles Returned		Number of Doses Used per Bottle	
	DF	MS	F	MS	F	MS	F
Main effects							
Monitoring	1	4017.60	8.50**	17.44	6.57*	28.81	5.24*
Contracting	1	2288.47	4.84*	24.97	9.41***	.17	.03
School Location	1	6340.29	13.42***	29.47	11.11**	6.81	1.24
2-way interactions							
Monitoring Contracting	1	196.85	.42	5.51	2.08	.61	.11
Monitoring School Location	1	15.23	.03	1.66	.63	.15	.03
Contracting School Location	1	7.25	.02	1.95	.73	6.27	1.14
3-way interactions							
Monitoring Contracting School Location	1	71.97	.15	.06	.02	.46	.08
Within (error)	216	472.50	---	2.65	---	5.5	---

* p < .05; ** p < .01; *** p < .001.

pleted contract agreements (p < .01). The 84 children who successfully completed contracting used an average of 70.2 doses, returned an average of 6 bottles, and used 11.2 doses per bottle.

Table 3 presents the results of the one-way ANOVA for the compliance measures by calendar use, contracting status, and school location. In this analysis, all subjects were assigned to 1 of 3 contracting groups: those who were not asked to contract, those who were asked to contract and did, and those who were asked to contract but did not. As can be seen from this table, the positive impact of monitoring was sustained for all 3 measures of compliance, as was the significantly higher overall dose usage and bottle return by suburban children.

By defining contracting as successful or not, the negative impact of contracting was clarified. Table 4 presents the results of a post hoc analysis, using Scheffe's test. It can be seen that contingency contracting significantly depressed all 3 measures of compliance only when contracting was not carried out. However, there was no difference in the compliance of children who did make a formal agreement with their parents and those children who were not asked to participate in contingency contracts at all. The original ANOVA (Table 2) was then repeated using the more precise definition of contracting. A significant interaction between monitoring and understanding contracting was revealed such that those children who were given calendars were more likely

TABLE 3. One-Way Analysis of Variance Summary

	<i>Number of Doses Used</i>			<i>Number of Bottles Returned</i>		<i>Number of Doses Used Per Bottle</i>	
	<i>DF</i>	<i>MS</i>	<i>F</i>	<i>MS</i>	<i>F</i>	<i>MS</i>	<i>F</i>
Calendar use							
Between	1	3306.13	6.64*	12.99	4.56*	28.99	5.35*
Within	222	497.96		2.85		5.42	
Contracting status							
Between	2	5067.89	10.80***	23.30	8.59***	17.89	3.30*
Within	221	469.31		2.71		5.41	
School location							
Between	1	5747.08	11.80***	25.72	9.21**	6.42	1.16
Within	222	486.97		2.79		5.52	

* $p < .05$; ** $p < .01$; *** $p < .001$.

TABLE 4. Results of Scheffe's Test for Contracting Status

	<i>Number of Doses Used</i>		<i>Number of Bottles Returned</i>		<i>Number of Doses Used per Bottle</i>	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Group 1 (no contracting) (103)	69.60	20.58	6.33	1.42	10.69	2.35
Group 2 (unsuccessful contracting) (37)	51.78	24.50	5.03	1.98	10.03	2.65
Group 3 (successful contracting) (84)	70.23	21.65	6.07	1.74	11.19	2.14
Ranges		3.49		3.49		3.49

* Denotes pairs of groups significantly different at $p < .05$. () = N.

to participate successfully in contracting, use more doses of mouthrinse ($p < .05$), and return more bottles ($p < .01$). This interaction did not influence the number of doses used per bottle.

Discussion

The results of this experiment support the results of a previous study by showing high compliance among second grade children (68% of the doses). The study also replicates the finding that this high compliance can be increased further by the systematic application of behavioral principles.

In this experiment, monitoring this simple daily preventive activity, significantly increased children's compliance. The use of a calendar increased usage over the 14-week period as well as increased the number of bottles returned. Thus, calendars seemed to serve a dual purpose, acting as a visual reminder of when the next appointment would be as well as providing daily feedback and intrinsic reinforcement through the "game" of placing a sticker each day.

The positive effect of calendars was true for both inner-city and suburban children, although suburban children more frequently remembered their appointments to return bottles. One simple explanation for this urban-suburban difference might be the fact that the mail reminders of appointments were more frequently returned by the post office as undeliverable for inner-city children. Secondly, it is probable that poorer urban families have other priorities competing for their attention that would overshadow the importance of returning mouthrinse bottles. This finding is in contrast to those reported by Kegeles et al.¹⁶ who found no significant difference between the compliance of inner-city vs suburban adolescents in a similar mouthrinse experiment.

The depressive effect of contracting was a somewhat unexpected finding. During the experiment it had been observed that some parent-child pairs immediately grasped the concept of contracting while others required one or more follow-up phone calls before successfully completing contracting. The negative effect of contingency contracting between par-

Steps To Follow

1. **Set a goal.**

Decide with your child how many days in the 2 weeks your child must use mouthrinse to earn a reward. Remember this is a new habit for your child. Try not to set a goal that is too easy or too hard.

2. **Choose a reward.**

There are 3 kinds of rewards parents can give their children.

Time - such as extra time with you, staying up a little later, extra TV time, extra time to play outdoors.

Activity - such as reading a story, going for a walk, playing a special game, or watching a special TV show.

Material - such as a balloon, comic book or other small toy or a favorite food for dinner.

As you can see, the reward should not be big or cost a lot of money.

3. **Reward your child for meeting the goal.**

If your child uses the mouthrinse as many days as the two of you agreed, give your child the reward. If your child doesn't meet the goal, remember that he or she will have a new chance to earn a reward every 2 weeks.

4. **Fill in the poster and send it back.**

Fill in the white sticker on the poster and sign it. Give your child the poster so that he or she can bring it back to school with the mouthrinse bottle.

FIG 3. Instructions were included outlining the basic principles of contingent reward and giving specific suggestions as to how to implement rewards to encourage mouthrinsing.

ents and children was only true for those parents and children who did not appear to understand completely the concept or were reluctant to participate in contracting. That some subject pairs failed to understand the concept of contracting is not surprising given that all instruction was in writing or over the phone and that formal contracting is a novel approach to changing behavior in many families.

Another explanation of this result might be that failure to participate in contracting represented a failure to comply with the request to do so. The association of failure to contract with lowered compliance in mouthrinsing might be due to a self-selection of noncompliant subjects or parents into this subgroup. Still another explanation is that contingency contracting added an additional behavior to what was at first a simple task, complicating it and presenting a barrier to compliance. It is important to note, that while unsuccessful contracting seemed to depress children's compliance, successful contracting did not enhance compliance significantly.

The interaction between monitoring and successful contingency contracting is not surprising from a the-

**FIGHT DECAY...
Every Day!**

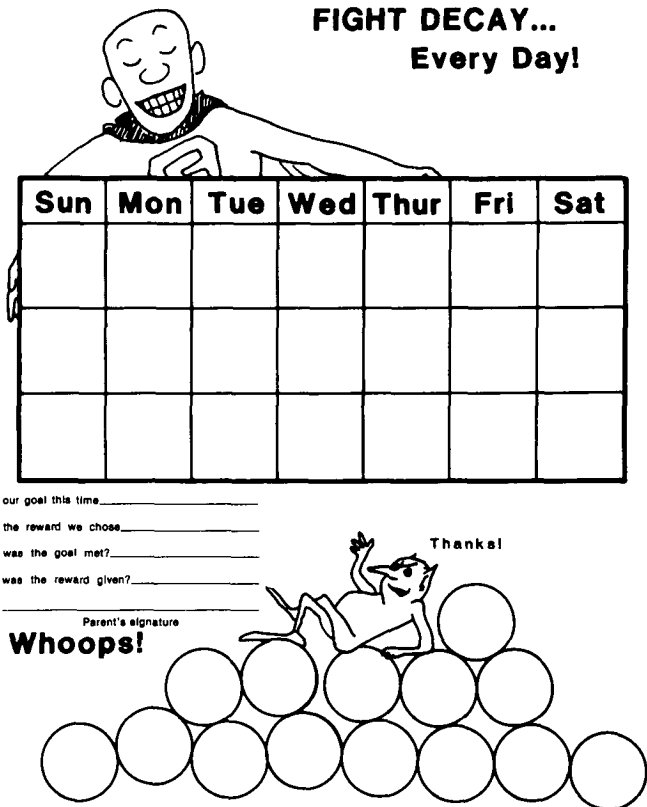


FIG 4. Contingency contracting stickers affixed to the poster or calendar served as evidence of the contract's existence and its fulfillment.

oretical standpoint, since in order to evaluate and reinforce a behavior, a record must be kept of progress toward the goal. Thus, the use of a calendar as a record of the child's use would facilitate parental feedback and reinforcement.

The results of this experiment and the one that preceded it¹ propose monitoring as a simple, reliable measure to increase the compliance of young school-age children. In light of the simplicity of this intervention, there seems little justification to pursue the concept of contingency contracting or parental involvement for simple preventive regimens such as mouthrinsing. The use of calendars and stickers easily can be instituted in schools, at home, or in the private dental office with minimal cost and with significant benefit.

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Dr. Cipes is an assistant professor and Ms. Miraglia is a research assistant II, Department of Behavioral Sciences and Community Health, University of Connecticut School of Dental Medicine, 263

Farmington Ave., Farmington, CT 06032. Reprint requests should be sent to Dr. Cipes.

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