Habit Reversal and Differential Reinforcement of Other Behaviour in the Treatment of Thumb-Sucking: An Analysis of Generalization and Side-Effects

Alison P. Christensen
Matthew R. Sanders
University of Queensland, Australia

Abstract

This study evaluated the generalization, maintenance, and negative side-effects of Habit Reversal (HR) and Differential Reinforcement of Other Behaviour (DRO) in the elimination of thumb-sucking. Thirty children who sucked their thumbs or fingers excessively were randomly assigned to a HR, DRO or wait-list control group. Observation data were collected in three observation settings. Both procedures effectively reduced thumb-sucking in both a training setting and in two generalization settings, and initial generalization effects maintained over time. However, both procedures resulted in some temporary increases in oppositional behaviour and produced low elimination rates. Differences between HR and DRO were not statistically significant; however parents evaluated HR somewhat more favourably than DRO.

Keywords: Thumb-sucking; Habit disorder; Treatment effects

Introduction

Thumb- or finger-sucking is a common developmental phenomenon in pre-adolescent children. It has been reported to occur in approximately 10% of children aged between 6 and 12 years (Lapouse & Monk, 1959; Roberts & Baird, 1971) and at 12 years of age, 22% of children surveyed by Baalack & Frisk (1971) were found to suck their thumbs. Thumb-sucking in young children under the age of 3 is not usually considered a serious problem warranting professional intervention (Herbert, 1975). However, parents often become concerned if the habit persists as the child grows older. For children 4 years of age and older, thumb-sucking has been associated with dental problems (Wright, Schaefer & Solomons, 1979). Lichstein (1978) suggested that the longer a child sucks his/her thumb after 6 years of age, the greater the risk of permanent dental malocclusion. Some of the problems associated with habitual thumb-sucking include open bite, overjet and closed-bite dental malocclusions (Norton & Gellin, 1968; Murray & Anderson, 1969). Orthodontic studies have indicated that hand- and object-mouthing produce dental and facial malformations, particularly if these behaviours persist after a child loses his/her primary teeth. Berland & Seyler (1968) argue that finger-sucking can unbalance jaw muscles which, once unbalanced, may distort the jaw even more as the child grows older. Some dental professionals advocate the use of intraoral devices to prevent the child from thumb- or finger-sucking; however, this approach is generally regarded as unpleasant for the child.

In some children, episodes of thumb-sucking are accompanied by additional self-stimulatory behaviours such as hair-twirling. In certain situations, these behaviours may be aesthetically offensive (Azrin, Nunn & Frantz-Renshaw, 1980). Additional reasons why persistent thumb- or finger-sucking is considered undesirable have been highlighted by Doke & Epstein (1975). The behaviour can preclude children from responding to questions during formal group activities (e.g. pre-school, school or day-care centres); it can interfere with spontaneous speech development during informal free-play activities; it can restrict the child's use of manipulative materials; and the habit can be accompanied by inattention to
planned activities. Parents of thumb-suckers frequently report that they attempt to curtail their child's habit by repeatedly giving instructions to stop. However, this form of parental attention may be inadvertently maintaining the thumb-sucking by positive reinforcement and this pattern of interaction could serve as an effective model for the child's siblings to gain attention. Thus from developmental, social and orthodontic perspectives, habitual thumb-sucking in the childhood years can be associated with negative consequences for children. Additionally, thumb-sucking can be a context for aversive interchanges with parents when attempts to suppress the behaviour are ineffective. While the developmental significance of the problem has been clarified, there is a paucity of well-controlled research into the developmental origins or etiological basis of chronic thumb-sucking. However, the results of some studies investigating the etiology of this problem suggest that thumb-sucking is more likely to be found among later-borns than first-borns (Johnson & Johnson, 1975), and that patterns of feeding and falling asleep (Ozturk & Ozturk, 1977) and particular temperamental characteristics (Lester, Bierbrauer, Selfridge & Gomeringer, 1976) may be related to thumb-sucking.

In view of the potential problems associated with persistent thumb-sucking, a variety of management procedures has been recommended to parents, including pacifiers (Knight & McKenzie, 1974), the wearing of thumb/finger splints (Lewis, Shilton & Fuqua, 1981), woollen gloves (Lassen & Fluet, 1978) the application of bitter-tasting substances to the fingers or thumbs, and wearing an oral device known as the palatal arch or crib (Haryett, Hansen & Davidson, 1970). However, few studies have experimentally evaluated these procedures.

Behavioural treatment studies, employing contingent reinforcement of non-sucking as the principle mode of intervention, have demonstrated that parents can be effectively trained to act as therapists (Ross, 1975; Friedman & McIntyre, 1970; Knight & McKenzie, 1974; Kauffman & Scranton, 1974; Hughes, Hughes & Dial, 1979; Martin 1975; Clowes-Hollins & King, 1982). However, parents’ applications of escalating Differential Reinforcement of Other Behaviour (DRO) schedules (Lichstein & Kachmärk, 1980; Lowitz & Suib, 1978; Ottenbacher & Ottenbacher, 1981), where reinforcement is contingent upon the absence of thumb-sucking for increasingly longer time-periods, have produced inconclusive results. In particular, generalization and maintenance effects have either been unreported, or when reported, unimpressive. A third operant procedure, Habit Reversal (HR), involves training the child to become aware of behaviours which usually precede the onset of thumb-sucking and situations wherein the habit is most likely to occur, then teaching the child alternative or competing responses which are incompatible with thumb-sucking. Azrin et al. (1979) found that parents can be trained to effectively apply this procedure and their results indicated that reduced levels of thumb-sucking were maintained over time. However, to date the generalization effects of the procedure across different settings has not been demonstrated. Setting generalization is particularly important in the treatment of self-stimulatory behaviour because children may discriminate between settings where parent-supervised training procedures operate (e.g. reinforcement contingencies) to control thumb-sucking and those where they are absent. In settings where parental surveillance is reduced, or the density of reinforcement or punishment differs from the training setting, thumb-sucking may still occur and be reinforced on an intermittent schedule.

One of the frequently raised concerns about treatments of behavioural disorders is the possibility that interventions may result in unprogrammed, undesirable changes in other behaviours. Indeed some evidence has shown that negative side-effects may occur. For example, Ottenbacher & Ottenbacher (1981) found that following the reduction in thumb-sucking of a 4-year-old girl, the child began bed-wetting. Doke & Epstein (1975) also reported an increase in inappropriate behaviours including spitting, masturbating and eyelash-pulling following the application of an oral overcorrection procedure which significantly reduced a 4-year-old's thumb-sucking habit. Clearly the effectiveness of a treatment procedure would be seriously questioned if following treatment there was a reliable yet unprogrammed deterioration in other social behaviours. The practical implementation of both HR and DRO involves parents in delivering instructions, establishing rules and providing consequences. These parent behaviours provide a possible context for changes in oppositional behaviours such as non-compliance and vocal-protesting. However, it is unclear from the literature if, when side effects occur, they persist over time and whether different behavioural treatments for thumb-sucking produce differing levels of non-targeted behaviour change. Increasingly, behavioural researchers have highlighted the need to address the social validity of treatment effects.
(Kazdin, 1977). Although parents have routinely acted as therapists in both DRO and HR treatments, there is little data available on parents' views about the acceptability and effectiveness of treatment techniques for thumb-sucking.

This study compared the efficacy of two group-training programmes for parents of thumb-suckers. Primarily the study assessed the differential effects of an escalating DRO procedure and the HR method. Secondly it aimed to provide systematic data on the generalization and maintenance effects of each treatment condition in three observational settings and to identify the extent to which both interventions produced variations in non-targeted oppositional behaviours as assessed through *in vivo* observations and reports by parents. Finally a treatment evaluation questionnaire was used to assess two social validation issues: the acceptability of the interventions used from the parents' perspective, and parents subjective evaluation of the extent of behaviour change associated with the interventions.

**Method**

**Participants**

Thirty children and their parents from metropolitan Brisbane participated in the study. Parents of these children were self-referred to the programme following a newspaper article. The media release slated that a research project was being conducted to assess treatment approaches for eliminating thumb-sucking. Parents were invited to apply for inclusion in the programme if they were experiencing difficulty with their child's thumb-sucking behaviour. The following criteria were used to select children as experimental subjects: the child's parents reported that the child engaged in thumb-sucking for prolonged periods of time, i.e. at least 10 minutes or longer, at least twice per day apart from bedtime; the child was not mentally retarded, hyperactive, displaying overtly psychotic behaviour, suffering from developmental delays, or currently receiving treatment from another source.

Twenty-eight of the children sucked their thumbs while two sucked two fingers. The mean age of the children was 6.3 years with a range of 4 to 9 years. Of the 30 children 43% were female, and none had previously sought professional assistance regarding how to deal with thumb-sucking, although 60% had at some time in the past applied a bitter-tasting substance to the child's fingers. From parents' self-reports, none of the children were experiencing dental problems associated with thumb-sucking as far as they were aware. Twenty-five of the children came from intact marriages, and the mean number of children per family was 1.5. Parents of the children were lower-middle- or middle-class, and were aged between 25 and 56 with a mean age of 35.8 years. There were twenty-two families whose parents had tertiary-level education, seven had secondary education, and one had completed only primary education.

Using a sampling-without-replacement procedure (Keppel, 1973), participants were randomly assigned to one of three experimental groups, namely HR, DRO and wait-list control group (WL), with 10 participants in each condition.

**Settings**

*Training setting.* At the intake of interviews, parents were asked to indicate one home setting which had been associated with high levels of thumb-sucking over the past 2 months. Television viewing was selected by 29 parents and one parent selected an afternoon play period. These settings served as the training setting and also provided a context to observe parent-child interaction.

*Generalization settings 1 and 2.* A second home setting (excluding bedtime) was also identified by the parent as occasioning high levels of thumb-sucking, and served as generalization setting 1. All children reportedly thumb-sucked at bedtime and this comprised generalization setting 2.

**Observational procedures and behavioural definitions**
For the training setting, eight observers were trained to employ a partial-interval-time-sample observation procedure (Sulzer-Azaroff & Meyer, 1977) to record thumb-sucking and oppositional behaviour in each observational setting. The instrument was similar to that used by Sanders & Glynn (1981), and measured specific categories of child behaviour described below. Child behaviour was sampled in observational blocks of 25 seconds (15 seconds for observation and 10 seconds for recording). This observe-record cycle was completed 72 times until 30 minutes of observation had been sampled. Observers were cued to either observe or record according to the schedule via an audio tape. Training for observers was conducted in three 2-hour sessions, and consisted of instructions and practice in the use of the observation schedule via video tapes, structured reading and group discussion. Training terminated when each observer attained a criterion level of 95% accuracy on an unfamiliar video example of child behaviour.

Observations of the child in the training setting were conducted on two different days in each phase for the HR and DRO groups and at baseline and follow-up for the control group. Either one or two observers arrived at the scheduled time and parents ensured that by that time the child was watching television or engaged in play. Observations were scheduled to coincide with a time when the child usually watched television, or in the case of one child, was at play. Parents were told that during observations they could continue their daily routine as usual; however, should the child wander away, they were asked to encourage their child to remain watching television for the duration of the observational session. The same procedures applied for the child who was observed during play. During observation sessions the observer avoided all eye contact with parents and children, and was told to ignore any approach made by a child. All family members were usually present during these observations, with the exception of fathers.

In generalization setting 1, observations were usually conducted by the mother who used an observational procedure similar to that used by the trained observers in the training setting. However, the parent was required to record only the occurrence or non-occurrence of thumb-sucking. Parents were cued to either observe or record via an audio tape which was scheduled to allow 15 seconds for observing and 10 seconds for recording. This cycle occurred 72 times during each 30-minute observational session. Once the child was involved in the activity, the parent began to observe from an unobtrusive position. At the bedtime setting (generalization setting 2), parents recorded thumb-sucking using a momentary-time-sampling procedure (Sulzer-Azaroff & Meyer, 1977). One hour after the child went to bed, irrespective of whether the child was asleep or not at the time, parents checked if the child was thumb-sucking and recorded the results of their observation on a checklist.

The definition of thumb- or finger-sucking given to parents was the enclosure of any finger or part of the hand by the lips or contact of the tongue with any finger or part of the hand. Episodes of thumb-sucking were role-played by the experimenter, and training concluded when parents reached a 95% criterion level of reliability. Two observations per setting were conducted in each experimental phase, and parents completed their observations on the same days as those done in the training setting.

The following child behaviours were observed by the trained observer:

Thumbsucking (TS); the enclosure of any digit or part of the hand by the lips or contact of the tongue with any digit or part of the hand;
Non-compliance (NC): refusal to initiate compliance with specific instructions within five seconds;
Complaints (CP): verbal complaints involving whining, screaming, vocal protests or temper outbursts;
Aversive mands (M-): instructions directed to another person by the child which were aversive or unpleasant (e.g. "Get out of my way!");
Aggression (PN): actual or threatened attacks of damage to another person or object (e.g. punching, biting);
Non-interaction (S): repetitive object manipulation or self-stimulation excluding thumb-sucking (e.g. face-slapping, absence of interaction with persons or play objects);
Oppositional (O): other inappropriate behaviours that are not included above (e.g. breaking family rules, teasing, etc.).
Appropriate verbal interactions (AV): a full interval of non-deviant activity in which intelligible speech on the part of the child occurs, either directed to the child's parents, siblings, pet or self; 
Appropriate activity or play (AE): a full interval of any other non-deviant behaviour or activity on the part of the child that cannot be scored as involving intelligible verbalizations.

In the training setting, observers recorded the occurrence of each behaviour category in each interval. If more than one category of behaviour was observed in any one interval, each individual category was separately recorded.

Measures

The dependent measure employed was the percentage of time intervals in which thumb-sucking and child oppositional behaviour occurred. Thumb-sucking behaviour was calculated by summing the number of intervals in which this occurred, dividing by the number of observation intervals (72) and multiplying by 100. Similarly, the number of intervals in which child oppositional behaviour occurred was summed, divided by the number of observation intervals (72) and converted to a percentage.

In both generalization settings, a similar procedure to that above was used to obtain the percentage of time intervals in which thumb-sucking occurred.

Other measures

A treatment evaluation questionnaire was used to assess parental attitudes towards procedures. This questionnaire sampled parents' views on the treatment programme in the following general areas: reasons for entering the project; attitudes toward treatment procedures; outcome of treatment. This was mailed to the 20 parents who received either the HR or DRO methods following treatment (post-training phase) and returned to the experimenter. In each treatment group, parents' responses to individual questionnaire items were summed.

Calculation of inter-observer agreement

Inter-observer agreement reliabilities were calculated on observational data in the training settings for all families. Reliability checks were conducted in 33.3% of observations in the training settings.

Overall occurrence, non-occurrence and chance agreement reliabilities were calculated separately on an interval-by-interval basis using the formulae described by Hopkins & Hermann (1977). Agreements were defined as any interval in which both observers recorded the occurrence or non-occurrence of the child behaviour categories.

Experimental design

The present study employed a group factorial design to assess the effects of each treatment condition on levels of thumb-sucking. Levels of thumb-sucking were assessed at pre-test, post-test and follow-up for the two treatment groups. For the control group, observational data were only available at pre-test and follow-up but not at post-test. For the WL control group thumb-sucking and child oppositional behaviour data were available at baseline and follow-up only, due to funding restrictions. Observations of thumb-sucking were conducted in three settings: a training setting and two generalization settings. Measures of child oppositional behaviour were confined to the training setting only.

Procedure

Baseline. Baseline observations were conducted to establish basal levels for each response category.
Habit reversal. The first-named author served as therapist for all parents in both treatment groups.
Training for mothers in each experimental condition was conducted in a departmental therapy room in groups of five. Training for each group of five was completed in a single 2-hour session.

The therapist initially gave parents an overview of how habit disorders in children develop. A brief explanation of the thumb-sucking in terms of social learning principles was outlined. Individual information was then given to each parent about the level of thumb-sucking and deviant behaviours of their child which occurred during the baseline observations in each setting. Parents then received a training manual and were instructed to employ the procedures for 10 consecutive days.

The HR procedure was adapted from those developed to treat the autistic behaviour of retarded children with undesirable oral habits (Azrin, Kaplan & Foxx, 1973; Foxx & Azrin, 1973; Freeman, Moss, Somerset & Ritvo, 1977) and to eliminate thumb-sucking, nervous habits and tics in normal children (Azrin & Nunn, 1973; Azrin et al., 1980). A summary of the training details is as follows. Treatment consisted of three phases. In the first phase, parents were instructed to (a) involve their child in a discussion about working together for the next 10 days to overcome the habit; (b) identify with the child the stimulus conditions associated with thumb-sucking by asking the child when this habit occurred most often, what was different about these times compared to other times, and encouraging the child to note the earliest sign that signalled the onset of thumb-sucking, e.g. hair-twirling; and (c) model and provide feedback on how the competing response exercise was to be performed. This involved clenching both fists, ensuring that the thumb was enclosed by the fingers, and slowly counting to 20. Parents gradually faded counting with the child. Parents explained that this exercise and counting should be done three times during the training setting if thumb-sucking occurred.

The first component, described above, was implemented prior to the first training session only. The second phase involved the parent setting the child up in the training setting and remaining within the immediate vicinity for the next 30 minutes. If thumb-sucking occurred, parents instructed the child to take the thumb or finger out of the mouth, to perform the fist-clenching exercise, and to count to 20, three times. If the child refused to co-operate, parents manually guided the child through the exercise.

In the third phase the parent explained that a training session would be held on the following day, and reminded the child to become aware of the earliest sign of thumb-sucking and to perform the exercise and counting. Finally, the parent explained the importance of not thumb-sucking at times outside the training sessions. Parents told the child that the exercise and counting were to be performed once, either at the earliest sign that signalled the onset of thumb-sucking or if thumb-sucking actually occurred. Parents were asked to watch the child as often as possible at other times, and to deliver the instruction to do the exercise once, if thumb-sucking occurred.

**Differential reinforcement of other behaviour.** The training format for this group was identical to that used with the HR group. Thus it included an explanation regarding acquisition and maintenance of thumb-sucking, the social-learning theory view, baseline details, and an instruction to apply the following procedure for 10 consecutive days. DRO involved an escalating schedule of reinforcement contingent upon non-occurrence of thumb- or finger-sucking. The procedure was implemented in two phases;

First, parents discussed with the child how they would be working together for the next ten days to overcome the habit. Parents explained that privileges could be earned by not thumb-sucking and that there would be daily rules for which tokens could be earned and exchanged for these privileges.

In the second phase, the parent set the child up in the training setting. Tokens were placed close to the child and the child was asked to select the rewards he/she would like to earn in exchange for the tokens that day. There were five rules and parents were instructed that one rule applied for at least two consecutive days. Each rule stated that a certain number of tokens would be earned if no thumb-sucking occurred for a specified length of time during the 30-minute training setting, e.g. rule one stated that one token would be earned every 3 minutes where no thumb-sucking occurred. Unless the child earned at least 80% of the number which could possibly be earned during the 30 minutes on each consecutive day, the same rule was applied for an additional day. With each successive rule, the inter-reinforcer interval was increased, until by rule five, the whole 30-minute training session constituted one interval. Each day, the parent explained the applicable rule to the child and showed him/her the passage of time on a clock face. The parent then began to discreetly watch the child. If no thumb-sucking occurred during the time specified, the parent placed a token in front of the child and ticked the record sheet. If thumb-sucking occurred, the parent stated that no
tokens would be earned while this continued and placed a cross on the record sheet. Parents were instructed to deal with attempts to leave the room by an Instruction to return, backed up by manual guidance prompts if necessary.

At the conclusion of the 30 minutes, both the parent and child counted the number of tokens earned. If the child had earned the specified number, the reward was delivered as soon as practicable following the session. Parents then explained that privileges could also be earned at other times if no thumb-sucking occurred for each successive 30-minute period. Parents were asked to divide the remainder of the child's waking day into half-hourly time blocks and to observe the child as often as possible.

Following an explanation of the procedures described above, the training commenced and continued for the next 10 days.

**Follow-up**

Three months following the termination of training, two further observation sessions were conducted in each setting.

**Results**

**Reliability of observations**

For thumb-sucking, the mean levels of inter-observer agreement were 98.8% (range 90.6%-100%) for overall reliability; 97.2% (range 96.2%-100%) for occurrence reliability; and 98.6% (range 97.5%-100%) for non-occurrence reliability, and in all instances exceeded chance levels of agreement. The mean levels of inter-observer reliability across all child deviant behaviours were 95.6% (range 89.3%-100%) for overall reliability; 91.4% (range 89.4%-100%) for occurrence reliability; and 92.2% (range 90.6%-100%) for non-occurrence reliability. Each instance exceeded chance levels of agreement.

The following format was employed in analysing the results of this study. First, a preliminary analysis was conducted to establish whether the experimental interventions were more effective than no treatment. Second, the results relating to the generalization and maintenance effects of the two treatment procedures are detailed. Third, the negative side-effects of treatment are described, and finally the social validity of the treatment procedures are considered.

**Preliminary analyses: Overall treatment effects**

Figure 1 presents the overall mean percentage of intervals of thumb-sucking observed at baseline and follow-up for the three treatment groups. These data were analysed in a univariate two-way ANOVA (treatment group x experimental phase), with repeated measures on the phase factor (Keppel, 1973). There were significant main effects for both treatment group and experimental phase \[F(2, 27) = 6.122, p < 0.006\], and \[F(1, 27) = 57.437, p < 0.000\], respectively. The interaction between treatment group and experimental phase was also significant \[F(2, 27) = 13.116, p < 0.000\].

Simple main effects analyses (Keppel, 1973) were conducted to locate the source of the interaction. The first analysis examined the simple main effect of the experimental phase on the WL control group. This showed that the WL control group's level of thumb-sucking did not significantly change from baseline to follow-up \[F(1, 9) = 0.08, p > 0.05\]. Two further analyses examined the simple main effects of the treatment groups at baseline and follow-up respectively. These results showed that whilst the differences between the three treatment groups were not significant at baseline \[F(2, 27) = 0.08, p > 0.05\], there was a significant difference between the groups at follow-up \[F(2, 27) = 11.86, p < 0.01\]. Subsequent Newman-Keuls analyses of mean pairs (Keppel, 1973) revealed that at follow-up, whilst the difference between the HR and DRO groups was not significant \[t(27) = 18.576, p > 0.05\], the WL control group differed significantly from both the HR and DRO groups \[t(27) = 24.176, p < 0.01\].
Hence, prior to treatment, the levels of thumb-sucking in each treatment condition were similar. The results show that at follow-up, both experimental interventions (HR and DRO) were associated with sustained and highly significant reductions in levels of thumb-sucking from baseline, whereas the level of thumb-sucking within the WL control group remained virtually the same. There was however, no significant difference between the HR and DRO groups at follow-up.

Thumb-sucking was totally eliminated in only a small number of subjects. The HR condition eliminated thumb-sucking in three children at post-training and two at follow-up. The DRO condition eliminated thumb-sucking in two children at post-training and one only at follow-up. These differences were non-significant \[ \chi^2(1) = 0.033, p > 0.05 \].

**Generalization effects**

To examine the differential generalization effects of HR and DRO in each observational setting, and at each phase, a univariate three-way ANOVA (treatment group X experimental phase X observational setting) with repeated measures on the experimental phase and observational setting was conducted. The phase means are displayed in Fig. 2. The analysis showed that the main effects of treatment group and observational setting were non-significant \[ F(1, 18) = 1.032, p > 0.05, \text{ and } F(2, 36) = 2.845, p > 0.05 \], respectively. However, there was a significant main effect of experimental phase \[ F(2, 36) = 60.205, p < 0.00000 \]. Subsequent Newman-Keuls comparisons of mean pairs showed that for both the HR and DRO groups there was a significant reduction in levels of thumb-sucking across observational settings from baseline to post-training \[ t(36) = 13.8967, p < 0.01 \] and from baseline to follow-up \[ t(36) = 15.8975, p < 0.01 \].

Hence, both treatment procedures resulted in decreases in thumb-sucking in both the training setting and the two generalization settings, and these effects were maintained from post-training to follow-up.

**Side-effects of treatment**

Consistent with the preliminary analysis conducted on levels of thumb-sucking, the same procedure was employed to assess the overall effects of treatment on levels of child oppositional behaviour at follow-up. The means are shown in Fig. 3. This two-way ANOVA showed that the main effects of treatment group
Fig. 2. Mean percentages of thumb-sucking in each observational setting for two treatment groups at each experimental phase.
and experimental phase were non-significant \( F(2, 27) = 0.404, p > 0.05, \) and \( F(1, 27) = 3.405, p > 0.05, \) respectively.

A second analysis was then conducted to examine whether immediately following treatment there were any changes in children's oppositional behaviour. Levels of child oppositional behaviour for HR and DRO at each experimental phase were analysed in a two-way univariate ANOVA (treatment group \( \times \) experimental phase) with repeated measures on the phase factor. The phase means are given in Fig. 4. This showed a significant main effect of experimental phase \( [F(2, 36) = 6.493, p < 0.00421] \); however, the main effect of the treatment group was non-significant \( [F(1, 18) = 0.138, p > 0.05] \) Subsequent Newman-Keuls analysis of mean pairs showed that at post-training, levels of child deviant behaviour for both the HR and DRO groups were significantly higher than baseline levels \( [t(36) = 4.1908, p < 0.05] \) and follow-up levels \( [t(36) = 4.6596, p < 0.01] \). However, the difference between baseline and follow-up levels of child deviant behaviour was non-significant \( [t(36) = 3.4795, p > 0.05] \). Hence, immediately following treatment, there was a temporary deterioration in levels of oppositional behaviour for both groups, although this effect was not present at follow-up.

**Social validation of treatments**

Tables 1 and 2 show the frequency of responses selected by parents in the HR and DRO conditions in evaluating their child at post-training. Two chi-square analyses (Keppel, 1973) were conducted on these data (treatment group \( \times \) level of thumb-sucking, and treatment group \( \times \) variations in non-target behaviours); however, they both yielded non-significant results \( [\chi^2(3) = 6.818, p > 0.05, \) and \( \chi^2(2) = 2.4, p > 0.05, \) respectively].

All parents in both conditions answered that they regarded the procedures as "fair and reasonable".

Table 3 summarizes the frequency of responses selected by parents in terms of recommending the programme to others, but the differences were non-significant \( [\chi^2(2) = 2.892, p > 0.05] \).

**Discussion**

The present study shows that HR and DRO are effective procedures for reducing thumb-sucking in pre-adolescent children. These findings confirm the work of earlier investigators who used either an escalating DRO procedure (Lowitz & Suib, 1978; Lichstein & Kachmarik, 1980; Ottenbacher & Ottenbacher, 1981) or a HR procedure (Azrin et al, 1980; Azrin & Nunn, 1973). This study extends earlier
Fig. 4. Mean percentages of child oppositional behaviour in the training setting for two treatment groups at baseline, post-training and follow-up.

Table 1. Frequency of responses selected by parents in evaluating levels of child thumb-sucking at the post-training phase

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<thead>
<tr>
<th></th>
<th>Greatly improved</th>
<th>Slightly improved</th>
<th>Remained same</th>
<th>Became slightly worse</th>
</tr>
</thead>
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<td>7</td>
<td>0</td>
<td>1</td>
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<td>3</td>
<td>3</td>
<td>0</td>
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</table>

Table 2. Frequency of responses selected by parents in evaluating variations in non-target behaviours at the post-training phase

<table>
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<th>Variations in non-target behaviours</th>
<th>Increases in inappropriate behaviour</th>
<th>Increases in appropriate behaviour</th>
<th>No behaviour change</th>
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</thead>
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<td>HR</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>DRO</td>
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<td>4</td>
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research by showing that both procedures resulted in generalization effects in extra training settings. Furthermore, initial generalization effects maintained over time without direct therapist contact or booster training sessions for parents. This type of treatment effect has been referred to as setting-time generalization (Drabman, Hammer & Rosenbaum, 1979; Sanders & James, 1983).

Of particular relevance in the present study were the findings related to negative side-effects of treatment. Both procedures were associated with small but statistically significant increases in oppositional behaviour in the training setting. Observational results were also confirmed by parental reports which indicated some deterioration in general behaviour at other times as well. While these unprogrammed changes in oppositional behaviour appeared to be temporary and by follow-up oppositional behaviour had returned to pretreatment levels, the temporary deterioration in social behaviour could be of clinical importance in some families. For example parents may abandon the programme because increases in negative behaviour may be viewed as more undesirable than the initial thumb-sucking problem. There are several possible explanations for this effect. First, reducing thumb-sucking may also increase the amount of time the child has available for other activities, including oppositional behaviour. Second DRO in particular involves the parent in delivering instructions and consequences for thumb-sucking. Many parents in this group commented that the withholding of privileges produced protests from children. In contrast, parents in the HR condition often reported that the procedure was viewed positively by children with both parties working towards a common goal, namely the elimination of the habit. Third, parental monitoring of the child which included prompts, instructions and consequences (withholding reinforcers) may function as aversive stimuli, and children may initially engage in instrumental escape behaviours (e.g. escalation of vocal protests) to terminate such stimuli. However, as the child gains better control over his/her thumb-sucking, the aversive properties of the procedures may dissipate.

Clearly further empirical work is needed to clarify the relative merits of these and other possible explanations. It would be particularly interesting to assess whether children with an initial negative reaction to treatment are also less successful ultimately in reducing or eliminating their thumb-sucking.

While differences in levels of thumb-sucking produced by HR and DRO failed to reach statistical significance in the training setting, one aspect of the data revealed that HR may have some clinical advantages when compared to DRO. These were anecdotal reports which showed that parents considered the treatment to be more of a collaborative endeavour and associated with fewer negative side-effects.

The study also demonstrated that brief group-training could be an effective forum within which to treat some habit-disordered children; this is consistent with other research examining the effectiveness of group-training procedures (e.g. O'Dell, 1974; Pevsner, 1982) with parents of behaviour-disordered children.

One additional feature of the results was the low overall elimination rate obtained by the two procedures at follow-up. However, like many behavioural excesses, the absence of reliable normative data makes it difficult to assess whether the level of reduction obtained brings the child within normal limits. While many parents in the present study reported being satisfied with the reduced levels of self-stimulatory behaviour, it would be interesting to assess whether children who achieve complete elimination maintain their gains better over longer time periods than children who engage in low rates of thumb-sucking at the termination of training.
In the present study the absence of control-group data at post-training limits our ability to draw causal inferences regarding the differential efficacy of the two experimental groups at post-training. However, despite this limitation, control-group data at both baseline and follow-up permit the maintenance of treatment effects to be rigorously explored. Furthermore, there is no convincing reason to assume that the control group at post-training would have evidenced any improvement in thumb-sucking. Inspection of follow-up data in fact show the untreated subjects maintained levels of thumb-sucking similar to those observed at baseline. However it is possible that the lack of observations at post-training for the control group was associated with different reactivity effects at follow-up compared with the treatment groups.

The present study has demonstrated the efficacy of HR and DRO in reducing thumb-sucking. However, the sample of children in this study did not have gross dental or language problems associated with this habit. To date the generality of HR and DRO has not been established in such severe cases, and remains an issue for future investigation. In view of the evidence indicating that potential dental problems could occur with persistent thumb-sucking after 6 years of age, it seems particularly relevant to intervene before this stage. Some modifications to the procedures employed in this study may improve clinical utility. Future research might profitably investigate methods which aim to increase children's level of engagement and participation in activities that are incompatible with the performance of thumb-sucking. Certain environments such as television-watching or bedtime may be high risk occasions for thumb-sucking because the on-going activity is compatible with the habit. Strategies such as planned activities training and incidental teaching (Hart & Risley, 1975; Sanders & Christensen, 1985) may be useful adjunctive procedures to increase children's participation in play, language, social activities and direct physical manipulation of objects and materials in the environment. This approach may decrease sedentary activity such as watching television which in turn reduces opportunities for self-stimulation. Secondly, the interventions might target not only on thumb-sucking, but also on behaviours which are correlated with the problem (Kazdin, 1982). Thus treatment approaches could be enhanced by focusing on additional self-stimulatory behaviours which accompany the thumb-sucking habit.

The final publication is available at Wiley Online Library

References


