Preventive Dental Care- Instruction and Contingency Management in the Acquisition and Maintenance of Oral Hygiene Skills

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PREVENTIVE DENTAL CARE: INSTRUCTION AND CONTINGENCY MANAGEMENT IN THE ACQUISITION AND MAINTENANCE OF ORAL HYGIENE SKILLS

by

Sandra K. Kallstrom

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
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Inadequate oral hygiene is one of the largest problems facing the dental profession to date. It is estimated that 98% of individuals suffer from dental problems associated with neglect. The objective of this study was to develop effective techniques which aided in the acquisition and maintenance of oral hygiene skills.

The study compared the effects of instruction and demonstration with contingency management on plaque percentage scores. A between-subjects design was used with one control and three experimental groups. The results indicated that oral hygiene instruction and demonstration appear to be ineffective in reducing plaque scores. Significant plaque reductions were found at post intervention for two experimental groups which utilized contingency management to improve home care dental hygiene performances. One contingency management group was also able to maintain significant plaque reductions at a six month follow-up. These results suggest that continued research on contingency management and preventive oral care is warranted.
ACKNOWLEDGMENTS

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Finally, I am also indebted to Mr. Marlin Trulsen for his knowledge in behavioral research, Mr. David Kallstrom for his computer graphic skills, and Ms. Marge Snow and Ms. MaryAnn Krisik for their understanding of preventive oral care. Thank you all, for your contributions to this project.

Sandra K. Kallstrom
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Preventive dental care: Instruction and contingency management in the acquisition and maintenance of oral hygiene skills

Kallstrom, Sandra Kay, M.A.

Western Michigan University, 1992
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CHAPTER I

INTRODUCTION

Tooth loss is not an inevitable byproduct of aging. Nevertheless, a large portion of the adults and children in the United States is affected by dental problems, most of which are attributable to inadequate or inconsistent oral hygiene. McCormack and McDermott (1988) estimate that 98% of all individuals in the U.S. have some history of dental caries and that, by the age of 17, 94% have had caries in their permanent teeth. While dental caries is the primary cause of tooth loss before the age of 30, a more serious problem for adults is periodontal disease. Inflammatory periodontal disease is the leading cause of tooth loss for adults, accounting for 50% of all missing teeth (Kraemer & Gurenlian, 1989). By the age of 40, periodontal disease exceeds caries as the major cause of tooth loss (Eid & Bandt, 1987).

Periodontal disease is characterized by deterioration of the bone and gum tissue supporting the teeth. Individuals suffering from this disease exhibit redness, swelling, and bleeding of the gum tissue. This inflammation in turn results in the development of periodontal pockets which separate the gum tissue from surrounding bone and result in eventual tooth loss (Genco, Goldman, & Cohen, 1990).

Periodontal disease is believed to exist, in varying degrees, in 80% of the U.S. population (Barrington & Nevins, 1990). Its onset can also be traced to an early age. Four out of five 13-year-olds begin to show some evidence of gum inflammation and swelling. Moreover, half of all 30-year-old adults and 80% of 40-year-old-adults are afflicted with nonreversible damage from the disease (Phillips,
1985). As these statistics suggest, dental caries and periodontal disease are among the most prevalent health problems in the United States.

While dental caries and periodontal disease are not life threatening, they often occur at a great financial cost for those afflicted. Current expenditures for dental services in the United States are approximately $32.8 billion. It is estimated that the average individual's base dental expense (check up, cleaning, etc.) is $134 per year. This expenditure is projected to increase to $334 per year by the end of the century (Waldman, 1989). Furthermore, the National Center for Health Services Research (now called Agency for healthcare Policy and Research, Rockville, Maryland) estimates that overall treatment costs for periodontal care are approximately $200 million per year. Oliver, Brown, and Loe (1989) also report that if the total U.S. population were treated for their periodontitis, $5 to $6 billion would be required annually. Finally, dental care is costly to the individual because he/she pays directly for the majority of the treatment. Direct out-of-pocket expense is estimated to be 61% for patients receiving dental treatment in contrast to 37% direct care expenses for non-dental health problems (Waldman, 1989).

Periodontal Disease and Prevention

Although the exact causes of periodontal disease are still being researched, the presence of bacterial plaque is widely accepted as a major contributor. Generally, the severity of periodontal disease is correlated with the amount of dental plaque on tooth surfaces and the amount of time in years that the plaque is present. Individuals with high levels of plaque appear to be more at risk for the development of severe periodontal disease (Cowell & Sheiham, 1981). Plaque control is the most effective means of preventing the onset of periodontal disease (Kraemer & Gurenlian, 1989). Plaque deposits can be removed through effective and frequent toothbrushing and oral
flossing. Unfortunately, plaque which is not removed from tooth surfaces hardens into calculus within two weeks time. Calculous deposits cannot be removed by normal home care. The build up of calculous deposits eventually separates supporting gum tissue and ligaments from the teeth, thus accelerating the periodontal disease process. To avoid the onset of periodontal disease, effective plaque removal must occur at least once every 24 hours (Carlos, 1983; Ohler, 1976). Compliance with this guideline appears to be low, as is evidenced by the prevalence of oral diseases within the population (i.e., 90%) (Babcock-Goodman & Suzuki, 1988).

Preventive dental care efforts (e.g., water fluoridation, public service announcements) have characteristically occurred on a community level, often under the auspices of state or local governments. In recent years, however, advocates of preventive oral care have spoken of benefits that could be derived by encouraging individuals to change behaviors that affect their oral health (Milgrom, Weinstein, Chapko, Grembowski, & Spadafora, 1988; Rayant & Theimer, 1980; Weinstein, 1978). Current beliefs are that the severity of dental problems associated with dental caries and periodontal disease could be greatly reduced if individuals practiced adequate oral hygiene (Cowell & Sheiham, 1981; Dunlap, 1990; Heasman & Jacobs, 1989; Milgrom et al., 1988; Woodall, 1990). These behaviors consist of effective daily plaque removal via brushing, flossing, use of a proxy brush, or toothpick, and visiting the dentist on a regular basis. Consistent performance of these behaviors could lessen most dental diseases and thereby avoid or limit expensive and often painful surgical and restorative dental procedures. Unfortunately, compliance with effective and frequent oral hygiene protocols has been less than optimal. Emling, Raikl, Greco, Shi, and Yankell (1991) report that most individuals significantly overestimate the amount of time spent on oral hygiene behaviors. They report that most individuals only brush about once per day and with limited efficacy.
with respect to plaque removal. Moreover, the average individual brushes for a
duration of approximately 30 seconds to 1 minute per brushing session (Hawkins,
cannot be adequately removed by the majority of individuals through daily
toothbrushing sessions of 1 minute or less. Carranza and Kenney (1981) report that
an average oral hygiene regime of 2 minutes daily removes about 40% of accumulated
plaque from tooth surfaces, leaving substantial plaque deposits to promote oral
diseases.

Dental flossing is also necessary for effective caries and periodontal disease
prevention. However, only about 10% of the population flosses daily and a large
percentage never floss (Chen & Rubinson, 1982; Craig & Montague, 1976; Emling
et al., 1991; Kleber & Putt, 1990). Flossing is difficult to teach and is characterized
by relatively low compliance rates. Hawkins et. al. (1986) suggest that a
toothbrushing duration of no less than 5 minutes and interproximal plaque removal via
flossing and other aids are necessary for effective plaque removal.

Review of the Behavioral Literature on Dental Prevention

Researchers have developed and evaluated educational and behavior
management programs to promote effective and consistent oral hygiene. Interventions
based primarily on instruction and prompting of effective oral hygiene are typically
unsuccessful (Milgrom et al., 1988). Weinstein (1989) studied the clinical
effectiveness of oral hygiene instruction on 71 “high” plaque patients. The results
revealed that only 20 of the 71 patients (28%) had effectively reduced mean plaque
scores. Further deterioration of tooth surfaces in an additional 13 patients was found
at 24 weeks.
Dentists report that oral hygiene instructions often appear ineffective and estimate that only about 50% of their patients comply with the instructions. Furthermore, many dentists are reluctant to provide extensive oral hygiene instructions, due in part to the lack of financial reimbursement for their educational efforts. It is estimated that only about 15% of dental professionals charge for this service (Milgrom et al., 1988).

Methods need to be identified for establishing and maintaining effective oral prevention programs. Although dental experimentation is ongoing, to date there are no treatments that allow individuals to take a passive role in their oral health care. There is a need to develop and evaluate effective techniques to promote active and regular dental hygiene at the individual level. Behavioral interventions have shown promise in changing behaviors that promote oral health. For example, a study by Dahlquist and Gil (1986) examined the use of a behavioral treatment package (i.e., utilized prompting, self-monitoring, corrective feedback, and criterion based reinforcement) in the acquisition of oral flossing skills in four children. The results indicated that flossing skills can be effectively taught to children and that interproximal plaque scores can be substantially reduced by using the behavioral treatment package. Further results revealed that the effects of the program could be maintained over time if the childrens' parents were actively involved in the intervention program.

Swain, Allard, and Holborn (1982) developed a school-based dental hygiene program for increasing the effectiveness of toothbrushing in children. The "toothbrushing game" consisted of dividing the classrooms into teams and checking the plaque count of several children on each team. The team with the lowest plaque count was declared the "winner" and rewarded with stickers and public posting of their names. The results indicated that not only did toothbrushing effectiveness greatly increase, but was maintained during a nine month follow-up check.
Similarly, a study by Blount and Stokes (1984) examined the effectiveness of an oral hygiene program designed to reduce plaque levels. The first phase of the program consisted of instruction on plaque removal, feedback on performance, and praise or encouragement for low levels of plaque. The second phase of the program added public posting of children's photographs contingent on low levels of plaque. The results indicated clear downward trends in plaque levels throughout the program.

Although studies seem to indicate that individuals can be taught effective oral hygiene skills, many professionals point out that long-term maintenance of these behaviors is problematic. Stewart and Wolfe (1989) examined the maintenance of newly acquired oral hygiene skills over time (i.e., the Bass toothbrushing and interproximal flossing skills). During a one year post-treatment evaluation and testing, it was discovered that the subject's brushing and flossing skills remained relatively intact or unchanged. However, overall reductions in plaque scores did not maintain. The authors concluded that the return to high levels of plaque was not due to a loss in brushing and flossing skills, but rather to a lack of subject motivation in maintaining proper oral care levels.

Iwata and Becksfort (1981) compared the effects of an oral hygiene education program with an oral hygiene education program plus a financial incentive. The incentive consisted of a dental fee reduction contingent upon reduced plaque scores. When compared with the Control Group (i.e., no education provided) at post-intervention, both the Education Group and the Education Plus Contingent Fee Reduction Group exhibited lowered plaque scores. The degree of plaque reduction, however, was generally greater for subjects in the group with the financial incentive and tended to maintain at a six month follow-up.
Statement of the Problem

As the previous studies indicate, some behavioral programs have reported promising results in establishing and maintaining preventive oral hygiene behaviors. Although many of the studies report reduced plaque scores, the practicality of their implementation in a dental practice is questionable. In addition to increasing oral hygiene behaviors and reducing plaque percentages, intervention programs must be pragmatic enough for the dental professional to implement into his/her daily practice. Iwata and Becksfort (1981) presented an innovative program which could realistically be utilized in a dental practice.

The present study extends many of the concepts included in Iwata and Becksfort's study. However, the current study attempts to more closely simulate conditions that exist in a standard dental office. For example, the population was expanded to include periodontal and nonperiodontal subjects. Oral hygiene training was also provided for every subject, including control subjects. Additionally, all the training was provided during regularly scheduled dental checkup intervals. These components approximate a preventive dental care program that could be incorporated into a general dental practice.

The current research compares oral hygiene instruction and demonstration with programs using varying degrees of contingency management. It is hypothesized that, when presented alone, instruction and demonstration will be relatively ineffective in reducing plaque percentage scores. It is also hypothesized that as additional contrived contingencies are added within programs, oral hygiene behaviors will increase and oral plaque percentages will decrease.
CHAPTER II

METHODOLOGY

Subjects

Subjects for this study were recruited from adult patients at a private dental clinic in central Wisconsin. All subjects were 18 years or older with a mean age of approximately 40 years. Subjects with “advanced” periodontal disease according to the diagnostic criteria of Capko (1990) and subjects requiring major dental work were excluded from the study. Subjects meeting the diagnostic criteria for “slight to moderate” periodontitis (Capko, 1990) and those without a periodontal diagnosis were allowed to participate.

Additionally, only those who had a consistent dental care history (i.e., had come for their two previous six month checkups) were recruited. During their regularly scheduled six month dental appointments, eligible subjects were asked if they would be willing to participate in the study. The patients were informed that the study would require some additional time for data collection and some training in oral hygiene techniques.

Subjects who volunteered to participate in the study, read and signed an Informed Consent form (see Appendix A) advising them of the requirements of the study, risks and benefits of the study, and of subject confidentiality and protection.

Subject Assignment

Subjects who met the above inclusion criteria, and agreed to participate were further divided into two separate groups based on the presence or absence of a prior
history of periodontal surgery. Subjects without a history of periodontal surgery were randomly assigned to one of three treatment groups to be discussed later. Subjects with a history of periodontal surgery were assigned to a separate experimental group.

Setting

The study was conducted at a general dental practice in central Wisconsin. The oral cleanings and data collection were performed by a qualified dental professional. The dentist was blind as to the assignment of subjects to experimental conditions.

Apparatus

Standard dental tools were used to assess the general oral health of each patient. Periodontal probes, having wire-ended picks of 15 millimeters in length, were used to measure periodontal pocket depths. Dental scalers were used for calculus removal.

Modified Patient Hygiene Performance (PHP) charts were used to assess and quantify the percentage of tooth surfaces with plaque deposits. These charts consist of drawings of upper and lower teeth with each tooth subdivided into five parts, all four sides of the tooth, and the chewing surface of the tooth. The charts, however, were modified to include the examination and recording of all the subject's teeth, not simply the preselected six teeth on standard PHP charts. Finally, all patients were provided with POH (Tulsa, Oklahoma) disclosing tablets (i.e., tablets used to indicate the presence of plaque), POH toothbrushes and POH unwaxed dental floss.
Dependent Variables

The primary dependent variables consisted of measures of oral plaque deposits, a predictor of periodontal health (Bader, 1989) and self-reports of toothbrushing and flossing behaviors.

Plaque Index

A plaque index was calculated for each subject by measuring the presence or absence of plaque deposits on the five surfaces of each tooth and dividing the number of tooth surfaces with plaque deposits by the total number of tooth surfaces for the individual. The resulting score provides a measure of the total percentage of plaque deposits within the mouth.

Prior to an oral cleaning, the subject took and dissolved a disclosing tablet that stained plaque deposits red. Shortly after the subject dissolved the disclosing tablet, the dentist examined each tooth surface indicating to a dental assistant those surfaces that were stained with the plaque disclosing chemical. The dental assistant then coded this information on the PHP chart.

Self-Reports of Brushing, Flossing, and Disclosing Tablet Use

Subjects assigned to the experimental groups were instructed to keep a daily record of their frequency and duration of toothbrushing, Bass brushing, interproximal flossing, and use of disclosing tablets (see Appendix B). The subjects were instructed to return the self-recording forms during their next scheduled dental appointment (i.e., upon completion of the intervention phase of the study).
Consumer Satisfaction

At the completion of the study, all subjects completed an anonymous consumer satisfaction survey regarding their satisfaction with the program and the extent to which they perceived the program as beneficial (see Appendix C).

General Procedure

Pre-intervention data were collected during a one month period in which the participating patients had their usual six month dental checkups. Assessment of plaque deposits occurred during a standard oral health examination, prior to any plaque removal efforts on the part of the dentist. These oral examinations ranged in length from 45 to 60 minutes depending upon the patient's oral condition.

During the first oral health examination, all subjects completed a Dental Assessment Form in which they identified conditions that affected their oral health. The subjects identified frequency of dental visits, frequency and duration of toothbrushing and reported their frequency of flossing.

All participants received the Standard Training Protocol for preventive dental care. A dental assistant and the primary researcher demonstrated and provided oral instructions in the Bass (1954) toothbrushing technique and interproximal flossing techniques. The rationale for using these techniques was explained, a verbal and written description of the techniques was provided, and a demonstration of the techniques occurred on a dentoform (i.e., oral model). The Bass technique has been reported to result in superior cleaning of the oral sulcus which is a requirement for the prevention of periodontal disease (Collins, Forrest, & Walsh, 1986; DiOrio, 1983; Harris & Christen, 1987; Wilkins, 1989; Woodall, Dafoe, Young, Weed-Fonner, & Yankell, 1989).
Standard Training Protocol Group

The subjects in the Standard Training Protocol Group received only the training outlined above. This intervention was designed to approximate the educational and preventive efforts that the typical dental practitioner provides to patients within his/her dental practice (Milgrom et al., 1988). As such, this group functions as a standard practice control group. Subjects were encouraged to practice these brushing and flossing skills on a daily basis.

Multicomponent Intervention Group

The subjects in the Multicomponent Intervention Group also received the treatment outlined above. However, in addition to being provided with oral care instructions and a demonstration, each subject was also provided with four additional treatment components in an attempt to improve his/her oral health. First, the subjects were trained to an acceptable criterion in Bass brushing and interproximal flossing. This occurred by having the subjects perform the appropriate brushing and flossing techniques on a dentoform and then within their own mouth. After a 3 minute practice period within their own mouths, subjects were evaluated and provided with verbal and guided feedback until an acceptable level of performance was attained. Subject performance of Bass toothbrushing and interproximal flossing was evaluated independently by the primary researcher and a dental assistant, according to the criteria presented in Appendix D. For specific skills noted as “unsatisfactory,” by either observer, the subjects received additional demonstrations and verbal instructions. Second, in addition to using disclosing tablets during the dental exam, the subjects were provided with disclosing tablets for home use and were instructed to use them twice per week. Third, the subjects were instructed to maintain a daily
record of their frequency and duration of toothbrushing, Bass brushing, flossing, and use of disclosing tablets (see Appendix B). The subjects were instructed to return the self-recording forms during their next scheduled dental appointment. Finally, all subjects within the Multicomponent Intervention Group were contacted by mail twice during the study. The first letter was mailed approximately 6 weeks after recruitment into the study and encouraged subjects to continue using the Bass brushing and interproximal flossing techniques and reminded them that the self-recording forms would be collected during their next dental appointments (see Appendix E). The second letter was mailed at approximately 18 weeks and provided subjects with feedback regarding their percentage of plaque deposits during the baseline phase and at the post-intervention assessment (see Appendix F).

**Multicomponent Intervention Group and Financial Incentive**

In addition to the four component treatment package described above (Multicomponent Intervention Group), this experimental group also participated in a lottery in which subjects who maintained lowered plaque scores had the opportunity to win $100 in a drawing. Plaque scores of no greater than 25% qualified subjects for entry into the lottery which was conducted at the completion of the intervention phase of the study.

**Multicomponent Intervention Group and Periodontal Disease**

This experimental group also received the same four component intervention described above under the “Multicomponent Intervention Group” (i.e., criterion training, disclosing tablets, self-recording forms, written feedback). However, all subjects within this group had a prior history of having periodontal surgery.
Experimental Design

A between-groups experimental design with repeated measures was used in this study. Two post-intervention measures were taken for all subjects, one at 3 months and one at 6 months. This allowed for the evaluation of change over repeated measures within groups. The first post-intervention measure was taken at the termination of the formal requirements of the Multicomponent Intervention (e.g., self-recording, required use of disclosing tablets) and thus represents the impact of the various interventions on plaque scores. The 6 month follow-up measure was taken 3 months after termination of the various treatment packages and thus represents the level of plaque removal which maintained in the absence of formal intervention requirements when subjects were simply encouraged to continue with their Bass toothbrushing and interproximal flossing technique on a daily basis.
CHAPTER III

RESULTS

Subject Attrition Rate

Of 39 individuals who agreed to participate in the study, 7 individuals dropped out before post-intervention data were collected, resulting in an attrition rate of 18%. The subjects who dropped were evenly distributed across treatment groups; 2 subjects dropped from the Standard Training Protocol Group, 2 dropped from the Multicomponent Intervention Group, 1 dropped from the Multicomponent Intervention Group and Financial Incentive, and 2 dropped from the Multicomponent Intervention Group and Periodontal Disease. The reasons varied for premature termination. One subject reported getting a new job which interfered with his participation in the program. Most subjects, however, reported that their schedules prohibited them from continued participation in the program.

Treatment Effects

Figures 1-4 show pre-intervention, post-intervention, and follow-up plaque scores for each individual in their respective treatment groups. Figure 5 depicts the same data as group means at each of the three plaque assessments. As Figures 1-4 indicate, pre-intervention plaque scores showed substantial between-subject variability with plaque scores ranging from a low of 22% to a high of 65%. Figure 5, however, indicates similar pre-intervention means for all four groups (Range of 37% for the
Figure 1. Plaque Percentage Scores at Pre-intervention, Post-intervention and Follow-up for Subjects in the Standard Training Protocol Group.

Figure 2. Plaque Percentage Scores at Pre-intervention, Post-intervention and Follow-up for Subjects in the Multicomponent Intervention Group.

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Figure 3. Plaque Percentage Scores at Pre-Intervention, Post-Intervention and Follow-Up for Subjects in the Multicomponent Intervention Group and Financial Incentive.

* Subject who received the financial incentive.

Figure 4. Plaque Percentage Scores at Pre-Intervention, Post-Intervention and Follow-Up for Subjects in the Multicomponent Intervention Group and Periodontal Disease.
Figure 5. Mean Plaque Percentage Scores at Pre-intervention, Post-intervention and Follow-up for the Four Groups.

Group 1 = The Standard Training Protocol Group  
Group 2 = The Multicomponent Intervention Group  
Group 3 = The Multicomponent Intervention Group and Financial Incentive  
Group 4 = The Multicomponent Intervention Group and Periodontal Disease

Multicomponent Intervention Group and Periodontal Disease to 42% for the Multicomponent Intervention Group and Financial Incentive).

Examination of Figures 1-4 reveals variable treatment effects for subjects. However, improvements may be generally seen in post-intervention and follow-up plaque scores for many subjects, especially those who received the three intervention approaches. As Figure 2 indicates, 5 of 7 subjects in the Multicomponent Intervention Group improved their overall plaque scores at 3 months, with 4 of these subjects achieving plaque scores below 25%. Similarly, Figure 3 shows that 7 of the 8 subjects in the Multicomponent Intervention Group and Financial Incentive improved in overall plaque percentages at 3 months and 5 of these subjects reduced their plaque scores below 25%. Finally, as Figure 4 indicates, 6 of the 7 Multicomponent Intervention Group and Periodontal Disease subjects improved their plaque percentages at 3 months, but only 2 reduced their plaque scores below 25%.
These data contrast with those of the Standard Training Protocol Group. Of the 9 subjects in this group 5 showed initial reductions in plaque scores at 3 months. However, the degree of reduction was generally minimal, as is depicted in Figure 1. Only 1 subject reduced her plaque score below 25%.

These general trends are evident in Figure 5 which shows pre-intervention, post-intervention, and follow-up plaque scores averaged across all individuals in each group. The Multicomponent Intervention Group showed a decrease in post-treatment mean plaque scores (i.e., from 40% to 29%). This reduction showed some reversal at the 6 month follow-up at 36%. Similarly the Multicomponent Intervention Group and Financial Incentive showed a decrease in the desired direction, with mean plaque scores of pre 42% and post 22%. This reduction was generally maintained at the 6 month follow-up at 25%. Finally, the Multicomponent Intervention Group & Periodontal Disease also showed a decrease in mean plaque scores of pre 37% and post 26%. Again, this reduction showed some reversal at the 6 month follow-up at 30%. These data contrast with those of the Standard Training Protocol Group. This group's mean plaque scores remained relatively unchanged throughout the duration of the study, with pre-intervention plaque scores of 41%, post-intervention plaque scores of 39% and follow-up plaque scores of 42%.

Statistical Analysis Between Groups

A one-way analysis of variance (ANOVA) was performed on the pre- and post-intervention scores for the four experimental groups. The results indicated that a significant difference was not found for pre-intervention plaque scores between groups. Subject randomization had occurred across groups and variability was evenly distributed. The analysis of variance revealed, however, a significant between group difference for post-intervention plaque scores: $F(3, 27) = 5.576, p < .005$. Further
analysis with the Tukey HSD test (Howell, 1982) revealed that both the Multicomponent Intervention Group and Financial Incentive (q obt. = 5.40 > q crit. 3.84) and the Multicomponent Intervention Group and Periodontal Disease (q obt. = 4.26 > q crit. 3.84) showed a significant difference, when compared to the Standard Training Protocol Group, in post-intervention plaque scores.

**Treatment Effects at Follow-up**

Six month follow-up scores were obtained for each subject in his/her respective groups. Figure 2 indicates that 4 of the 7 Multicomponent Intervention Group subjects obtained or maintained improved follow-up plaque scores at 6 months and 1 subject maintained the 25% or better plaque criterion. Figure 3 shows that 5 of the 8 Multicomponent Intervention Group and Financial Incentive subjects maintained improved follow-up plaque scores at 6 months and 3 subjects maintained the final plaque criterion of 25%. Finally, Figure 4 indicates 4 of 7 subjects in the Multicomponent Intervention Group and Periodontal Disease group maintained improved plaque scores and that 3 subjects met the 25% plaque criterion. This contrasted with the Standard Training Protocol Group. Of the 9 subjects in this group, 4 maintained plaque reductions at 6 months. However, the degree of reduction was generally minimal, as is depicted in Figure 1.

**Statistical Analysis Between Groups at Follow-up**

A one-way analysis of variance (ANOVA) was also performed on the follow-up scores for the four experimental groups. The ANOVA indicated a significant difference between follow-up plaque scores across treatment groups: $F(3,26) = 3.286, p < .05$. A post hoc Tukey test further identified that the Multicomponent Intervention Group and Financial Incentive (q obt. = 4.149 > q crit. 3.90) when
compared to the Standard Training Protocol Group maintained a significant effect over time.

Statistical Analysis Within Groups

A one factor ANOVA-repeated measures was also performed on the pre-intervention, post-intervention, and follow-up data within groups. The results indicated that a significant difference was not found between pre-intervention, post-intervention and follow-up plaque scores for the Standard Training Protocol group and the Multicomponent Intervention Group. However, the repeated measures ANOVA revealed a significant difference for pre-intervention, post-intervention and follow-up plaque scores for the Multicomponent Intervention Group and Financial Incentive (F(2, 12) = 14.911, p = .0006) and the Multicomponent Intervention Group and Periodontal Disease (F(2, 12) = .0399). A post hoc Scheffe test (p < .05) further revealed that both interventions led to significant improvements in post-intervention plaque scores, but these improvements were only maintained in the 6 month follow-up for the Multicomponent Intervention Group and Financial Incentive.

Self-Report Behavioral Measures

Figures 6 and 7 show group means for pre-intervention estimates of brushing and flossing behaviors for all four groups and means based on subject self-recordings during week one and 12 of the intervention phase of the study for the three experimental intervention groups. As Figure 6 indicates, the pre-intervention means of estimates of daily toothbrushing duration ranged between 7 and 10 minutes. The week following the initiation of the intervention, subjects self-recorded toothbrushing showed means between 18 and 20 minutes. The corresponding group means at 12 weeks ranged between 15 and 20 minutes with slight decreases in duration reported in
Figure 6. Average Daily Brushing Duration for the Four Groups.

Figure 7. Average Number of Flossings Per Week for the Four Groups.

Group 1 = Standard Training Protocol Group
Group 2 = Multicomponent Intervention Group
Group 3 = Multicomponent Intervention Group + Financial Incentive
Group 4 = Multicomponent Intervention Group & Periodontal Disease
the Multicomponent Intervention Group and Financial Incentive and the Multicomponent Intervention Group & Periodontal Disease.

Figure 7 shows that group means for pre-intervention estimates of the frequency of weekly flossing ranged between 3 and 6 times per week. The group means based on self-recorded flossing during the first full week after the intervention was implemented ranged between 5 and 7 flossings per week. The most notable increases in flossing were reported in the Multicomponent Intervention Group and the Multicomponent Intervention Group and Financial Incentive. The group means calculated on the basis of data recorded during Week 12, again ranged between 5 and 7 flossings per week.

A Pearson correlation was performed on the self-reported measures of brushing and flossing at 12 weeks and the subjects' post intervention plaque percentage scores. Figure 8 indicates a strong negative correlation ($r = -.663$) between brushing duration and amount of plaque present on tooth surfaces. Generally, as brushing duration increases, plaque percentages decrease. Forty-four percent of plaque variability is accounted for by brushing duration ($r$-squared = .44).

Figure 9 indicates a negative correlation ($r = -.235$) between the number of flossings per week and amount of plaque present on tooth surfaces. As the number of flossings per week increases, the degree or percentage of plaque may decrease. Five percent of plaque variability is accounted for by the number of flossings per week ($r$-squared = .005).

When conducting the Pearson correlation across treatment groups, pre-estimate scores of brushing duration were used for subjects who incorrectly filled out the self-recording forms or did not comply with the requirement of filling out the forms. Similarly, subjects who incorrectly filled out the flossing component of the self-recording forms or who did not comply with the requirement, were not scored for
Figure 8. Pearson Correlation Between Subject Recorded Brushing Duration and Plaque Percentage Scores.

Figure 9. Pearson Correlation Between Subject Recorded Number of Flossings Per Week and Plaque Percentage Scores.
flossing for the week. This decision is supported by the low percentage of flossing for the population in general (i.e., 10%). Five subjects of 22 did not adequately comply with the self-recording form requirements.

Consumer Satisfaction

The results of the consumer satisfaction survey are summarized by groups in Table 1. As can be seen from examination of this table, all groups generally agreed that the program was beneficial to their oral hygiene and found the program worthy of recommendation to others. Of special note is that participants in the Multicomponent Intervention Groups reported being strongly motivated to engage in oral hygiene behaviors.
Table 1
Consumer Satisfaction With Dental Hygiene Program
1=Strongly Disagree/ 5=Strongly Agree

<table>
<thead>
<tr>
<th>Consumer Satisfaction Questions</th>
<th>Group 1 mean</th>
<th>Group 2 mean</th>
<th>Group 3 mean</th>
<th>Group 4 mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you believe this oral hygiene program improved your dental health?</td>
<td>4.0</td>
<td>4.8</td>
<td>4.9</td>
<td>4.0</td>
</tr>
<tr>
<td>2. Would you recommend a program similar to this for someone that you know in order to help improve their oral hygiene?</td>
<td>4.1</td>
<td>4.5</td>
<td>4.3</td>
<td>4.4</td>
</tr>
<tr>
<td>3. Did this oral hygiene program motivate you to engage in oral hygiene behaviors more often?</td>
<td>3.9</td>
<td>4.3</td>
<td>4.9</td>
<td>4.1</td>
</tr>
<tr>
<td>4. As a result of this program, do you have a better understanding of what causes or contributes to periodontal disease (gum disease)?</td>
<td>4.0</td>
<td>4.5</td>
<td>4.1</td>
<td>3.6</td>
</tr>
<tr>
<td>5. Did this program require more effort on your part than it was worth?</td>
<td>2.0</td>
<td>2.0</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>6. Would you participate in a project such as this one again?</td>
<td>3.4</td>
<td>4.2</td>
<td>4.0</td>
<td>3.4</td>
</tr>
</tbody>
</table>
CHAPTER IV

DISCUSSION

The results suggest that the multicomponent treatment approaches improved oral health, as measured by plaque reduction, with statistically significant effects reported at post-intervention for both the Multicomponent Intervention Group and Financial Incentive and the Multicomponent Intervention Group and Periodontal Disease. The results of the treatment approaches appeared to contrast strongly with the results of the Standard Training Protocol Group in which mean plaque scores remained relatively unchanged for the duration of the study. Furthermore, oral hygiene instructions and demonstrations, which were provided in the Standard Training Protocol, appeared to have little enduring effect on patient motivation or compliance with home care regimes. This observation suggests that the added financial incentive and a prior history of periodontal disease may have been important motivational variables contributing to the observed effects.

Although the majority of dental practitioners probably provide oral hygiene instructions and demonstrations, when presented alone these techniques do not appear strong enough to motivate patients to brush and floss daily. Rather, it appears that dental practitioners need to develop stronger contingencies to better control the behaviors of consistent brushing and flossing. In the absence of naturally occurring contingencies to motivate such behavior, contrived contingencies such as those tested herein seem justified. The multicomponent intervention approaches appeared to provide some of this control in varying degrees. The most notable effects, in terms of plaque reduction, were reported in the Multicomponent Intervention Group and Financial Incentive. This group not only had substantial decreases in plaque

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percentages at post-intervention, but the decreases were maintained at the six month follow-up. This appears to suggest that although the four component intervention (i.e., criterion training, disclosing tablets, self-recording forms, written feedback) may have an effect on brushing and flossing behaviors, stronger contingency management procedures may be needed to maintain the improved oral hygiene behaviors over time. The Multicomponent Intervention Group and Financial Incentive provided for this by the addition of the lottery system. The contingency of the financial incentive appeared to motivate subjects to more consistently comply with the home care regime. However, the relative contributions of each component of the intervention need to be more thoroughly examined to understand their full impact on brushing and flossing behaviors.

Positive effects on the post-intervention plaque scores were also reported for the Multicomponent Intervention Group & Periodontal Disease. Unfortunately, these gains were not maintained at the six month follow-up. Perhaps the reason for some of the initial success with the intervention is patient history. Patients with a history of periodontal disease may be more likely to comply with a treatment program for several reasons: First, the patients have had contact with the consequences of inadequate oral care. They may have experienced directly the symptoms which can accompany periodontal disease, such as excessive bleeding of gum tissue, loosening of the teeth from the surrounding bone, tooth loss, or physical pain which can occur as the oral condition deteriorates. Second, the patients may have paid directly for the expense of periodontal surgery. These events in combination provide an aversive condition or establishing operation (Michael, 1990) for those behaviors that reduce the probability of periodontal disease. For example, the statement of a rule, (e.g., “Bass brushing will help my gums to become healthier.”) functioning like an establishing operation, might increase the reward value of events or stimuli (i.e., clean teeth, stimulated gum
tissue) which result from compliance with the rule (Malott, 1990). In conclusion, a history of periodontal disease and the development of specific rules surrounding its prevention may increase patient motivation or compliance with an oral hygiene regime.

Initial results for this group (Multicomponent Intervention Group & Periodontal Disease) may also be partially attributed to a stronger response class for the behaviors of brushing and flossing. For example, it is likely that periodontal patients have received additional skills training in the areas of brushing and flossing as a part of their treatment for the disease. Therefore, additional contingencies, which were provided by the multicomponent treatment approach, may simply have motivated the patients to perform their existing skills. However, once the additional contingencies of the treatment approach were removed, compliance began to deteriorate. Continuation of contrived or added contingencies may be necessary to maintain long-term effects in oral hygiene behaviors.

Examination of the Intervention Components

The multicomponent intervention approaches attempted to provide a treatment program which would motivate patients to brush and floss daily. The program was designed using behavioral principles, but is simple enough to use in the standard dental practice. The first component of the program consisted of training subjects to an acceptable criterion in Bass toothbrushing and interproximal flossing. This aspect of the program was unique because these skills were not only explained and demonstrated, but also practiced by the patients within the dental office under the supervision of qualified professionals. This practice period provided direct verbal and guided feedback in an attempt to better establish these skill within patients'
repertoires. Observers could be sure that the patients actually mastered the skills involved.

The second component of the program attempted to establish stronger contingency control over Bass brushing by using disclosing tablets. Although disclosing solution was available, tablets were elected for use in the dental office in an attempt to approximate the exact procedures patients would be required to perform during home use. It was hypothesized that generalization of tablet use would occur in the home environment more readily if tablets were also used in the dental office. The program attempted to establish stronger contingency control over Bass brushing by having patients consistently utilize disclosing tablets which stain plaque deposits red. This chemical staining process would provide patients at home with immediate feedback on the effectiveness of their toothbrushing skills.

The program also attempted to develop more control over the behaviors of brushing and flossing by having the patients keep daily records of their oral hygiene regimes. By recording the frequency and/or duration of their brushing, flossing, or disclosing tablet use, the patients could potentially become more "aware" of consistently performing these skills on a daily basis. In fact, upon completion of the study, several subjects commented that without the requirement of the self-recording forms, they did not maintain daily brushing and flossing behaviors. They simply became less "aware" of the frequency with which they performed these behaviors.

The multicomponent treatment approach also provided written feedback for patients in an attempt to motivate them to perform the oral hygiene regime consistently. Letters regarding patient plaque percentages are often required by insurance companies and could easily be given to patients in an attempt to gain patient compliance with oral hygiene programs. With proper equipment (i.e., computer and
graphics program), plaque percentages could be given immediately to dental patients upon completion of the oral exam or dental appointment.

One aspect of the multicomponent intervention approach also utilized the addition of a financial incentive. Upon initial examination, dental practitioners may be resistant to the concept of financially rewarding subjects for low plaque percentages. But when examined more closely, in terms of time and effort requirements needed by practitioners to perform prophylactics or oral cleanings, financial records may appear more favorable. For example, dental practitioners could develop a self supportive program, which provides discounts for patients with lower plaque percentages, because less time and effort would typically be required for cleaning these patient's teeth. If these patients were informed that they would receive a $10 discount for plaque percentages below 25%, perhaps they might consistently brush and floss.

The multicomponent intervention approaches were developed to achieve patient cooperation with daily toothbrushing and flossing behaviors. Getting this cooperation is probably one of the most difficult tasks in the dental profession, but it is also one of the most necessary steps towards prevention and oral health. Although the program was not successful with every patient, it did have positive effects on many in terms of plaque reduction. Additional research would be beneficial in determining the contribution of the various components of the program.

Limitations and Directions of Future Research

The multicomponent treatment approaches appeared to be successful for individuals in terms of plaque reduction and increasing consistent toothbrushing and flossing behaviors. Some potential limitations of the study, however, should be identified and reviewed in order to benefit future research in dental compliance.
One limitation of the current research was a failure to examine pre or existing subject skills in toothbrushing and flossing behaviors. Assessment of existing oral response classes could have provided additional information on the various results derived in the intervention approaches. For example, without this information it is difficult to determine if the successes of the program were attributable to enhanced skills training or greater contingency management procedures. Perhaps most dental patients already possess the necessary skills needed for oral health, but are unable to effectively manage existing environmental contingencies. Therefore, dental professionals could potentially spend less time in the traditional training modes of instructing and demonstrating oral skills and concentrate more on developing effective contingencies to manage patient home care performances.

Another limitation of the research was a failure to more directly monitor frequency and/or duration of brushing and flossing behaviors. Individuals, in general, are reported to have a tendency to overestimate the amount of time spent engaging in oral hygiene behaviors (Emling et al., 1991). Similarly, upon reviewing the various intervention results, it was found that participating subjects also potentially overestimated the amount of time spent on oral behaviors. For example, not only were pre-estimates of brushing durations high (10 minutes), but self-recorded intervention data appeared to be inflated as well—at 15 to 20 minutes per day. Although the average brushing duration for subjects probably did increase as a result of participation in the program, most subjects probably did not spend the amount of time brushing per day which they recorded. More accurate subject recording of brushing and flossing behaviors would be useful in determining the exact amount of time necessary for significant plaque reduction. Effective intervention programs could be developed with accurate information on the amount of time which is necessary to procure oral health.
The results of the current study, in terms of plaque reduction, could also be potentially enhanced in future research. When examining the PHP recording charts it became evident, by cumulated plaque deposits, that clear brushing patterns existed for many of the participating subjects. Many of the subjects utilized what will be coined as “cosmetic brushing” (i.e., brushing teeth which are visible, for example, when an individual smiles). Subjects tended to concentrate their oral hygiene efforts on the upper and lower eight front teeth in the mouth. In other words, the labial, and to a lesser degree the buccal, surfaces of the teeth were relatively plaque free. Lingual and interproximal surfaces of the teeth, however, typically contained the majority of the plaque deposits. These data strongly suggest that many subjects are not flossing and brushing their entire mouth. Rather, subjects tend to concentrate on surfaces which are highly visible and easily accessed. Although the present program was effective in terms of plaque reduction, future plaque programs could potentially benefit by attending to “cosmetic brushing” patterns. Additional training could be provided to enhance skills in “whole mouth brushing” and to increase subject awareness of ineffective brushing patterns. Thus enhancing reduction of plaque percentages within the entire mouth.

Finally, it is important that future research attempts to include inter-observer reliability checks on obtained plaque scores. Because of a limited number of staff, the current study was unable to include plaque score reliability checks. If utilized, this procedure would more strongly confirm obtained results in future research. Reliability checks would also be relatively easy to incorporate into a plaque program which existed in a clinic with more staff members.

Due to the delayed effects of oral neglect, management of preventive behaviors can be extremely difficult. Traditional approaches, such as oral instruction and demonstration, appear to have limited success with dental compliance. The current
study attempted to arrange environmental contingencies which more strongly supported the acquisition and maintenance of preventive oral behaviors. The positive results of the study appear to suggest that future research in contingency management and oral prevention is warranted. Perhaps with the development of additional techniques the problem of noncompliance could be more effectively managed.
Appendix A

Informed Consent Form
Informed Consent Form

I freely consent to participate in this study on dental health care. I understand that this study is attempting to measure the effectiveness of various oral care techniques. I know that the study will continue for a duration of six months, during which time I will be expected to keep my scheduled dental appointments. In addition, I am aware that I am free to withdraw from the study at any time without penalty and that the results obtained from this study will be kept confidential. I understand that this study will benefit me in that I will receive the dental supplies of floss and toothbrushes which are necessary for successful completion of this program, and I will be given the opportunity to learn effective oral care techniques so as to maintain better teeth and gums. I understand that there will be no risks associated with being a participant in this study above and beyond the small risks and discomfort associated with a routine tooth cleaning. In the unlikelihood that any emergencies were to develop during the standard cleaning, routine emergency procedures as established by the Abbotsford Dental Clinic would be implemented. I know that I will have the opportunity to be debriefed about the study and to receive the most effective alternative intervention if I choose to do so. I also understand that I may contact the researcher and her advisor of the study if more information about the project is required or if I have any concerns about the project.

Sandy Kallstrom
Western Michigan University
Kalamazoo, Michigan 49008-5078

I further understand that I will receive a copy of this statement.

Participant
Signature ________________________________
Date______

Researchers
Appendix B
Self-Recording Form
<table>
<thead>
<tr>
<th>Name: Date</th>
<th>Sunday No. times/Total time</th>
<th>*Monday No. times/Total time</th>
<th>Tuesday No. times/Total time</th>
<th>Wednesday No. times/Total time</th>
<th>Thursday No. times/Total time</th>
<th>*Friday No. times/Total time</th>
<th>Saturday No. times/Total time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brushed (with paste)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bass Brushed (no tooth paste)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flossed all teeth (X the days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used Red Tablets (X the days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Required days for disclosing tablet use
Appendix C

Consumer Satisfaction Form
Consumer Satisfaction with Dental Hygiene Program
1= strongly disagree/ 5=strongly agree

1.) Do you believe this oral hygiene program improved your dental health?
   1  2  3  4  5

2.) Would you recommend a program similar to this for someone that you know in order to help improve their dental health?
   1  2  3  4  5

3.) Did this oral hygiene program motivate you to engage in oral hygiene behaviors more often?
   1  2  3  4  5

4.) As a result of this program, do you have a better understanding of what causes or contributes to periodontal disease (gum disease)?
   1  2  3  4  5

5.) Did this program require more effort on your part than it was worth?
   1  2  3  4  5

6.) Would you be a participate in a project such as this one again?
   1  2  3  4  5

Any additional comments or recommendations?

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----------------------------------------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------------------------------------
Appendix D

Criteria for Bass Toothbrushing and Interproximal Flossing
Criteria for Bass Toothbrushing and Interproximal Flossing

**Bass toothbrushing skills**

1.) Proper hold or grip on toothbrush?

The subject should be holding the toothbrush gently. Similar to how one holds a pencil. A firm grip with fingers inclosing the brushing is considered unsatisfactory.

2.) Holding brush at proper angle?

The subject should be holding the brush at approximately a 45 degree angle. The subject should be brushing at an upward 45 degree angle on the top teeth and at downward 45 degree angle on the lower teeth. If the subject is not brushing upward and downward in the appropriate areas, their performance is unsatisfactory.

3.) Did subject brush all mouth areas?

When demonstrating their Bass brushing skills the subjects needs to show competency in brushing both an upper and a lower facial area of their teeth. The subject also needs to demonstrate competency in brushing a lingual area of their upper and lower teeth.

4.) Did subject use proper angle of brush in each area?

It is essential that the subject uses the proper angle in all areas of the mouth in which their Bass brushing skills are demonstrated. If the correct angle (i.e., 45 degrees, upward brush on top teeth, downward brush on lower teeth, etc.) does not occur in all areas the subject performance is unsatisfactory.
Interproximal Flossing Skills

1.) Did the subject take an appropriate amount of floss for mouth?

Eight to ten inches is consider appropriate. If less than eight or ten inches is taken the subjects performance is considered unsatisfactory.

2.) Did the subject use a proper hold or grip on the floss?

The grip on the floss must be short (i.e., no more than an inch and a half in length) and tight (i.e., the floss must be held with a taunt, firm grip). Any deviation is considered unsatisfactory.

3.) Did the subject "wrap" each tooth while flossing?

During their flossing demonstration, did the subject "wrap" each tooth (i.e., scrap up along the sides of each tooth while between the teeth)? If the subject simply pushes and pulls the floss between each tooth their performance is unsatisfactory. If the subject uses a "see saw" method while flossing, their performance is unsatisfactory.

4.) Did the subject move floss while flossing?

Did the subject regrip and move their floss every fourth tooth or so? If the subject did not regrip or move their floss during their demonstration, then their performance is unsatisfactory.

5.) Did the subject remember to do their back most molars?

Did the subject remember to do at least two of their back molars during their demonstration. If the subject did not floss two of their back most molars during the demonstration, then their performance is unsatisfactory.
Appendix E

Letter Number One to Subjects
Western Michigan University
Kalamazoo, MI 49008

Date

Name, Subject

Dear : 

I am writing regarding the Dental Hygiene project in which you are participating. We are very interested in your progress with the program and have scheduled the return appointment for you on (date). The appointment is only to check your progress with the program and will be brief. It will take approximately 15 minutes.

When you come in for your return appointment, please bring the self recording forms or data sheets which you have been completing. These forms are essential in order to give us an accurate representation of the program results.

We greatly appreciate your willingness to participate in this program and hope that the additional training has been beneficial to you. If you have any questions regarding the project or if your scheduled appointment conflicts with another obligation, please call the Dental Clinic as soon as possible to arrange an alternative appointment (XXX) XXX-XXXX. Thank you.

Sincerely,

Sandy Kallstrom

Wayne Fuqua, Ph. D.
Appendix F

Letter Number Two to Subjects
Date

Name, Subject

Dear :

I am writing regarding your progress with the Dental Hygiene project in which you are participating. We appreciate your willingness to participate in this program and hope the additional training has been beneficial to you.

As a part of this program we want to provide you with information on the data which we have collected. On your initial assessment or dental check-up, the percentage of plaque on your upper teeth was % and on your lower teeth was %. This gave you an overall plaque ratio of %.

The intervention check or your second dental appointment revealed a plaque ratio of % on your upper teeth and plaque ratio of % on your lower teeth. For an overall composite ratio of %.

We have requested that you continue utilizing our program until your third and final check which occurs at the (date). You will be contacted shortly regarding your final, follow-up data check. Examining your progress will require little time for completion of this program. Thank you for your participation.

Sincerely,

Sandy Kallstrom

Wayne Fuqua, Ph.D.
Date: November 14, 1990

To: Sandy Kallstrom

From: Mary Anne Bunda, Chair

Re: HSIRB Project Number 90-10-27

This letter will serve as confirmation that your research protocol, "Preventive Dental Care: Instruction and Contingency Management in the Acquisition and Maintenance of Oral Hygiene Skills," has been approved after expedited review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Wayne Fuqua, Psychology

Approval Termination: November 14, 1991
BIBLIOGRAPHY


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Michael, J. (1990). *Motivative relations or establishing operations*. Kalamazoo, MI: Western Michigan University, Department of Psychology.


