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Use of Disclosing Tablets and Signs of Gingival Bleeding for Improving the Oral Health and Oral Hygiene Status of Adult Dental Clients

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USE OF DISCLOSING TABLETS AND SIGNS OF GINGIVAL BLEEDING
FOR IMPROVING THE ORAL HEALTH AND ORAL HYGIENE
STATUS OF ADULT DENTAL CLIENTS

by

Susan Elaine Thompson
B.S. May 1975, Old Dominion University

A Thesis Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
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MASTER OF SCIENCE
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Approved by

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ABSTRACT

USE OF DISCLOSING TABLETS AND SIGNS OF GINGIVAL BLEEDING FOR IMPROVING THE ORAL HEALTH AND ORAL HYGIENE STATUS OF ADULT DENTAL CLIENTS

Susan Elaine Thompson
Old Dominion University, 1980
Director: Michele L. Darby

The purpose of this investigation was to compare two methods for improving the oral health and oral hygiene status of adult dental clients. Fifty subjects were selected and randomly assigned to two groups. Over a 75-day period, Group A used disclosing tablets on a daily basis to reveal dental plaque deposits to control dental disease; Group B used signs of gingival bleeding on a daily basis to control dental disease. Clients attended four appointments for oral evaluation. The oral health and oral hygiene status of the adult dental clients were measured at each appointment using the Gingival Bleeding Index and the Plaque Index, respectively. Data analysis revealed no significant difference in the mean Plaque Index scores of both groups after manipulation of the experimental variable ($p > 0.05$). Analysis of data did reveal a significant difference in the mean Gingival Bleeding Index scores of Group B after manipulation of the experimental variable ($p \leq 0.05$).

Results indicated that the recognition of signs of gingival bleeding for improving oral health was more effective than the "traditional" method of using disclosing tablets and was at least as effective as the "traditional" method for improving the oral hygiene status of adult dental clients.

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Chapter 1

INTRODUCTION

Research findings indicate that the major cause of tooth loss in an adult population is periodontal disease.¹ Further investigations show that by age 40, more than half of the population in the United States have lost at least one tooth because of periodontal disease. Twenty million adults have lost all their teeth and periodontal disease is believed to be the chief cause of the loss.²

Microbial plaque has been found to be the primary cause of gingival and periodontal diseases.³ Neglected or

¹E. F. Allen, "Statistical Study of Primary Causes of Extraction," Journal of Dental Research (December 1944), p. 453; P. J. Brekhus, "Dental Disease and Its Relation to the Loss of Human Teeth," Journal of the American Dental Association (December 1929), p. 2237; J. L. Henry and J. C. Sinkford, "The Economic Social Impact of Periodontal Disease," Public Health Reports (March-April 1979), p. 172; C. Lundquist, "Tooth Mortality in Sweden: A Statistical Survey of Tooth Loss in the Swedish Population," Acta Odontologica Scandinavica (November 1967), p. 298.

²Allen, *ibid.*; Public Health Service Publication No. 1482, Health Information Series No. 133, "Research Explores Pyorrhea and Other Gum Diseases--Periodontal Disease," U. S. Government Printing Office, Washington, D.C. (1966); Henry and Sinkford, p. 172.

³D. A. Grant, I. B. Stern, and F. G. Everett, Orban's Periodontics, 4th ed. (St. Louis: C. V. Mosby, 1972), p. 143.

improper oral hygiene resulting from failure to remove dental plaque deposits from the teeth is the primary etiological factor in gingival and periodontal diseases in the adult population.⁴

A multitude of methods for teaching an individual to control dental disease by removing dental plaque have been investigated.⁵ Investigations conducted indicate that various types of disclosing agents have been demonstrated to be effective in enabling dental clients to identify plaque more effectively;⁶ however, few investigations have studied the effect of using signs of gingival bleeding as an indicator of dental plaque retention.⁷

⁴M. Berg, M. Burrill, and L. S. Fosdick, "Chemical Studies in Periodontal Disease. IV. Putrefaction Rate as an Index of Periodontal Disease," Journal of Dental Research (February 1947), p. 67; J. L. Bernier, "The Role of Inflammation in Periodontal Disease," Oral Surgery (Vol. 7, 1949), p. 583; H. Løe, E. Theilade, and S. B. Jensen, "Experimental Gingivitis in Man," Journal of Periodontology (May-June 1965), p. 177; S. Ramfjord, "Local Factors in Periodontal Disease," Journal of the American Dental Association (June 1952), p. 647.

⁵S. S. Arnim, "The Use of Disclosing Agents for Measuring Tooth Cleanliness," Journal of Periodontology, (May 1963), p. 227; L. A. Friedman et al., "Bacterial Plaque Disclosure Survey," Journal of Periodontology (June 1974), p. 439; D. W. Cohen et al., "A Comparison of Bacterial Plaque Disclosing in Periodontal Disease," Journal of Periodontology (June 1972), p. 333; R. C. Edwards et al., "Evaluation of Two Different Approaches to Plaque Control Instructions," U. S. Navy Medicine (April 1972), p. 214.

⁶Arnim, *ibid.*, p. 227.

⁷M. C. Godin, "The Effect of Visual Feedback and Self-Scaling on Plaque Control Behavior," Journal of Periodontology (January 1976), p. 34.

The "traditional" methods of motivating dental clients to improve oral health and oral hygiene have been concerned with the identification of dental plaque through the use of disclosing agents. Since dental plaque accumulates on the teeth and gingiva and causes inflammation and bleeding, disclosing agents aid in the removal of the harmful plaque accumulations by staining the plaque, making it easier to identify areas in need of further cleansing.

The purpose of this investigation was to assess and compare the effectiveness of two methods used by dental clients for improving oral hygiene and oral health status. The first method investigated was the "traditional" approach, the use of disclosing tablets by dental clients to identify dental plaque deposits and to aid in properly cleansing the teeth. The second method studied was the use of gingival bleeding as an indicator of areas in need of effective cleansing. Disclosing agents stain only the dental plaque that adheres to the tooth surfaces and collects around the gingiva. Identification of bleeding points in the gingiva not only suggests plaque accumulation but also indicates to the client the harmful effects of dental plaque accumulation on the gingiva.

Statement of the Problem

The intent of this investigation was to answer the following questions:

1. Is the recognition of gingival bleeding by dental clients as effective as the use of disclosing tablets by dental clients to improve their oral hygiene as measured by the Plaque Index?

2. Is the recognition of gingival bleeding by dental clients as effective as the use of disclosing tablets by dental clients to improve their oral health as measured by the Gingival Bleeding Index?

Significance of the Problem

Data from dental research indicate that oral deposits are a major etiological factor in the development of periodontal disease.⁸ Epidemiological data demonstrate a positive correlation between periodontal destruction and oral debris.⁹ Clinical trials have shown that accumulation of oral debris leads to gingival inflammation.¹⁰ Biochemical and microbial research has suggested that periodontal disease is a result of an interplay between

⁸Löe et al., "Experimental Gingivitis in Man," p. 177.

⁹A. A. Lovdal et al., "Incidence of Clinical Manifestations of Periodontal Disease in Light of Oral Hygiene and Calculus Formation," Journal of the American Dental Association (January 1958), p. 21.

¹⁰M. K. Hine, "The Use of the Toothbrush in the Treatment of Periodontitis," Journal of the American Dental Association (August 1950), p. 158.

bacterial activity and host tissue.¹¹ Other investigations have corroborated the common clinical observation that as soon as bacterial deposits are removed from the area, gingival inflammation subsides.¹² In view of these research findings, a need exists for the investigation of current approaches to dental disease control programs. Clinical trials testing various methods of disease control programs might provide data on the most effective approach to dental disease control.

The most effective method of preventing dental disease at this time is the mechanical removal of dental plaque.¹³ The "traditional" approach for identifying plaque on a tooth surface, the use of disclosing solution, relies on the staining of tooth accumulated materials and only implies that plaque is present. The pathogenicity of dental plaque cannot be determined by stain.¹⁴

Some dental indices measure the clinical appearance of the gingival tissue. Measurement of a clinical sign, like bleeding, is a visual and concrete indication of

¹¹S. D. Schultz-Houdt et al., "Bacterial Factors in Non-Specific Gingivitis," Journal of Dental Research (August 1954), p. 454.

¹²S. P. Ramfjord et al., "Subgingival Curettage Versus Surgical Elimination of Periodontal Pockets," Journal of Periodontology (May 1968), p. 167.

¹³S. S. Arnim, "The Use of Disclosing Agents for Measuring Tooth Cleanliness," Journal of Periodontology (May 1963), p. 227; Richard Chase et al., "A Comparison of Bacterial Plaque Disclosing in Periodontal Disease," Journal of Periodontology (June 1972), p. 333.

disease activity. Gingival bleeding as an early indication of gingivitis and its sequela, periodontitis, has been studied by several researchers, including Massler and Schour,¹⁵ Løe,¹⁶ and Muhlemann.¹⁷ In 1971, Muhlemann demonstrated that bleeding from the gingival crevice is the earliest clinical sign of gingivitis, preceding discoloration and swelling of the gingival interdental units.¹⁸ Muhlemann's index score was determined by the amount of bleeding from the gingival sulcus during probing and by the clinical appearance of the marginal and papillary gingival units. Further support for bleeding as an early clinical sign has been provided by Lennox and Kopczyk,¹⁹ who noted that gingival bleeding points do not correlate directly with clinical inflammation, but rather precede apparent inflammation.

Gingival bleeding is an early indication of gingival disease; therefore, the recognition of gingival bleeding

¹⁴Carter and Barnes, p. 801.

¹⁵M. Massler et al., "Occurrence of Gingivitis in Suburban Chicago School Children," Journal of Periodontology (July 1950), p. 146.

¹⁶Løe et al., "Experimental Gingivitis in Man," p. 178.

¹⁷M. Muhlemann and S. Son, "Gingival Sulcus Bleeding: A Leading Symptom in Initial Gingivitis," Helvetica Odontologica Scandinavica (October 1971), p. 107.

¹⁸Carter and Barnes, p. 801.

¹⁹J. A. Lennox and R. A. Kopczyk, "A Clinical System for Scoring a Patient's Oral Hygiene Performance," Journal of the American Dental Association (April 1973), p. 849.

might be used by oral health professionals and their clients to monitor gingival health and oral hygiene. Educating clients to recognize gingival bleeding as an indicator of oral health and oral hygiene status would be accomplished with a minimum of materials. Research findings in the dental literature on the use of this approach in client education are limited. Results of this investigation might have a significant influence effecting a change in the current approach to dental disease control education in private dental practices as well as in community oral health programs.

Private Dental Practices. The recognition of signs of gingival bleeding by adult dental clients can be implemented easily in client education sessions in the private dental office. Dental clients need only to be instructed to recognize the signs of gingival inflammation, like color change and bleeding. The use of the Gingival Bleeding Index by the dental client to indicate bleeding points would be a simple approach to evaluate the presence or absence of gingival disease. The supplies needed for gingival evaluation are a piece of dental floss, a mouth mirror, and a larger mirror. Modifications and special oral physiotherapy aids can be used by clients who have difficulty with the flossing procedure. In the dental practice, the examination can be assessed either by the dental client, dental health professional, or

preventive assistant. Self-assessment by the dental client is encouraged and the client is guided to accept responsibility for carrying out his/her oral hygiene procedures.

Community Oral Health Programs. The recognition of gingival bleeding for improving the oral health and oral hygiene status of community groups might significantly influence the utilization of dental auxiliary personnel as well as decrease the incidence of dental disease in the population. The most appealing factor in using this dental disease control approach in the community would be the minimal amount of materials and supplies needed to initiate such a preventive oral health and oral hygiene education program. Moreover, the manpower needs would be minimal. Dental disease control education sessions designed to teach target populations to recognize bleeding as a sign of gingival inflammation could be conducted by trained dental assistants. This would afford the dentist and the dental hygienist the opportunity to render therapeutic and preventive services that require more complex professional skills and judgements. If effective, this approach to oral health and oral hygiene education would be manageable to implement in the community school systems and would reach a significant number of clients on a cost effective basis.

Definition of Terms

The significant terms of this investigation are as follows:

Dental Hygienist--

. . . an oral health educator who utilizes preventive, therapeutic, and education methods for the control of oral diseases to aid individuals and groups in attaining and maintaining oral health.²⁰

Disclosing Tablets--a solid form of an erythrocin dye applied to the teeth to stain and identify dental plaque, making the plaque clearly visible.²¹ Disclosing tablets were used primarily as an aid to oral hygiene instruction by the subjects in Group A. This was one of the independent variables of the study.

Gingivitis--an inflammation of the gingiva, characterized by redness, edema, bleeding, exudate, and (less frequently) pain.²²

Oral Health Status--the score obtained using the Gingival Bleeding Index to determine the presence or absence of gingival inflammation and bleeding. The oral health status was one of the dependent variables in the study.

²⁰E. M. Wilkins, Clinical Practice of the Dental Hygienist, 4th ed. (Philadelphia: Lea & Febiger, 1976), p. 799.

²¹American Academy of Periodontology, "Glossary of Terms," Supplement to the Journal of Periodontology (1977), p. 8.

²²Grant, p. 206.

Oral Hygiene Status--the score obtained using the Plaque Index to determine the amount and location of soft deposits on the teeth. The oral hygiene status was one of the dependent variables in the study.

Gingival Bleeding Index (GBI)--an index developed to measure the absence or presence of gingival inflammation as determined by bleeding from the interproximal gingival crevice.²³ The GBI scoring procedure consists of noting areas of bleeding, non-bleeding areas, and areas that are not scored because of open contacts or diastemas. The Gingival Bleeding Index scores were measured on each interproximal area (tooth #2-15 and 18-31 inclusive).²⁴

Plaque Index (PI)--an index designed to measure the amount and location of the soft debris aggregates. The Plaque Index consists of a scale from zero to three. The PI measured the absence of plaque (0) to the abundance of soft matter (3) within the gingival crevice and on the tooth surface.²⁵

Assumptions

For the purpose of this investigation, the following assumptions were made:

²³Carter and Barnes, p. 801.

²⁴Ibid., p. 802

²⁵H. Löe, "The Gingival Index, the Plaque Index, and the Retention Index Systems," Journal of Periodontology (June 1967), p. 610.

1. The presence or absence of gingival bleeding as measured by the Gingival Bleeding Index is a valid indicator of the subject's oral health status.²⁶

2. The presence or absence of dental plaque as measured by the Plaque Index, is a valid indicator of the subject's oral hygiene status.²⁷

3. Plaque removal and disease control techniques used during the prophylaxis appointment and at home by the subjects were effective in reducing or eliminating gingival bleeding and plaque accumulations.

4. All subjects were exposed to the same oral health instructions.

5. The principal investigator was a valid and reliable scorer throughout the investigation.

6. Through random assignment of subjects to the two groups, group differences in oral health status, dental knowledge, and manual dexterity were controlled.

7. Threats to internal validity were controlled by the use of two equivalent experimental groups and random assignment of subjects to each group.

8. The principal investigator was unaware of the subjects' group status when collecting the PI and GBI scores to control investigator bias.

²⁶Carter and Barnes, p. 801.

²⁷Löe, p. 610.

Limitations

The validity and reliability of the results might be limited by the following factors:

1. Some of the subjects might have had previous oral hygiene services performed and might have received dental disease control instructions by a private dentist or at the Old Dominion University Dental Hygiene Clinic; therefore, previous oral hygiene knowledge might have influenced the oral health status of subjects.

2. Subjects received oral prophylaxis procedures from different student dental hygienists who might have varied in the execution and sequence of clinical procedures performed. To control for this limitation, an orientation for the dental hygienists was conducted and a standardized format for sequence of preventive and therapeutic oral hygiene procedures to be performed was presented prior to the prophylaxis appointments.

3. Subjects' knowledge of their participation in an experiment might have affected their oral hygiene and oral health status.

4. The sample population was randomly selected from the client records at the Old Dominion University Dental Hygiene Clinic. The sample population selected might have possessed a high concern for their oral health, limiting the generalization of findings to similar populations who regularly seek dental care.

5. The Gingival Bleeding Index was not immediately reproducible. Once the floss was placed in the crevice, and a recording made, it was extremely difficult to replicate the same observation.

Hypotheses

The following hypotheses were tested:

Ho₁. There is no statistically significant difference at the 0.05 level in the oral health status of clients who used disclosing tablets to control dental disease and clients who recognize signs of gingival bleeding to control dental disease, as measured by the Gingival Bleeding Index.

Ho₂. There is no statistically significant difference at the 0.05 level in the oral hygiene status of clients who used disclosing tablets to control dental disease and clients who recognized signs of gingival bleeding to control dental disease, as measured by the Plaque Index.

Methodology

A randomized groups, pretest-posttest research design was used to determine the effect of two different methods of dental disease control on the oral health and oral hygiene status of adult dental clients over a 75-day period. Fifty adult dental clients between the ages of 18 and 60 years were randomly assigned to one of two groups receiving dental disease control instructions.

One group was instructed to use disclosing tablets to identify the accumulation of dental plaque in order to see areas in need of further cleansing. The other group was instructed to identify areas of gingival bleeding as an indication of the presence of dental plaque retention in order to identify areas in need of further cleansing.

Each of the subjects attended four appointments at intervals of three weeks, 1.5 months, and 2.5 months. The first appointment included recording the initial oral hygiene and oral health status of each client utilizing the Plaque Index and the Gingival Bleeding Index, respectively, disease control instructions, and an oral prophylaxis. Disease control instructions were presented by means of a film presentation and standardized instructions on home care procedures. All subjects were issued one soft toothbrush, 75 yards of unwaxed dental floss, and a mouth mirror. The group using disclosing tablets was issued a 75-day supply of disclosing tablets for home care procedures. Prophylaxis procedures were performed by second-year dental hygiene student clinicians at Old Dominion University. The initial appointment was approximately four hours in length. At each subsequent appointment, subjects were scored using the Plaque Index and Gingival Bleeding Index to assess their oral hygiene and oral health status. The scoring procedures were performed by the principal investigator at each of the four appointments.

Analysis of data revealed no significant difference in the mean Plaque Index scores of Group A and Group B after manipulation of the experimental variable, method of disease control used ($p > 0.05$). Data analysis did reveal a significant difference in the mean Gingival Bleeding Index scores of Group A and Group B after manipulation of the experimental variable ($p \leq 0.05$). Results indicated that the recognition of signs of gingival bleeding for improving the oral hygiene status of adult dental clients was at least as effective as the "traditional" method of using disclosing tablets for improving oral hygiene. Data analysis revealed that the recognition of signs of gingival bleeding for improving the oral health status of adult dental clients was more effective than the "traditional" method of disease control for improving oral health.

Chapter 2

REVIEW OF THE LITERATURE

The literature revealed that a considerable body of knowledge on the distribution and severity of gingival disease has been accumulated.¹ Epidemiological and experimental studies have demonstrated positive relationships between bacterial plaque formation and gingival inflammation.² Past research relevant to the investigation was reviewed and addressed in three sections:

- (1) dental plaque and the etiology of gingival disease,
- (2) the indices used to assess oral hygiene and oral health, and
- (3) methods used in dental disease control.

¹H. Løe et al., "The Natural History of Periodontal Disease in Man," Journal of Periodontal Research (Vol. 13, 1978), p. 550; S. P. Ramfjord et al., "Epidemiological Studies of Periodontal Diseases," American Journal of Public Health (September 1968), p. 1722.

²Niklaus P. Lang et al., "Toothbrushing Frequency As It Relates to Plaque Development and Gingival Health," Journal of Periodontology (July 1973), p. 396; H. Løe, E. Theilade, and S. B. Jensen, "Experimental Gingivitis In Man," Journal of Periodontology (May-June 1965), p. 177); A. Lovdal et al., "Incidence of Clinical Manifestations of Periodontal Diseases in Light of Oral Hygiene and Calculus Formation," Journal of the American Dental Association (January 1958), p. 21.

Dental Plaque and the Etiology of Gingival Disease

Extensive research conducted during the past decade has indicated a significant relationship between bacterial plaque and the development of periodontal disease in man and in experimental animals. Bacterial plaque can be defined as an acquired gel-like mat, closely adherent to a tooth or restorative surface. The mat is composed of an organic film (cuticle or pellicle), microbial masses and their products, organic and inorganic components from oral secretions, shed epithelial cells, and blood cells. The major components are the cuticle, microbial masses, and intermicrobial matrix.³

Löe's⁴ classic study of experimental gingivitis indicated that gingival inflammation could be caused in individuals with healthy gingiva by discontinuing all oral hygiene procedures. The cessation of oral hygiene procedures led to an observed sequence of gingival changes and oral flora. Löe also observed that reestablishment of oral hygiene procedures resulted in healthier gingiva.

In Norway, a study of industrial workers determined that the efficiency of oral hygiene could be correlated with the accumulation of soft and hard deposits and

³Irwin D. Mandel, "Dental Plaque: Nature, Formation, and Effects," Journal of Periodontal Research Supplement (1974), pp. 7, 106.

⁴Löe et al., "Experimental Gingivitis in Man," p. 177.

gingivitis, frequency and depth of gingival pockets, and degree of alveolar bone loss.⁵ Common to all of these observations was the consistent finding that interproximal areas were affected most seriously, with lingual surfaces moderately affected, and buccal surfaces least involved. Subjects practicing effective oral hygiene techniques after the study began were able to reduce gingivitis considerably. Subjects failing to maintain oral hygiene procedures were not able to reduce their gingival inflammation as significantly as those subjects practicing effective oral hygiene.

Löe et al.⁶ conducted a longitudinal study of the initiation and progression of periodontal disease between two groups. One group of subjects practiced effective oral hygiene procedures. The other group did not practice and maintain effective oral hygiene procedures. Baseline data indicated that the group not practicing effective oral hygiene techniques manifested greater gingival recession and moderate to severe gingival inflammation. However, the group practicing effective oral hygiene manifested only slight gingival recession and gingival inflammation.

⁵A. Loydal et al., p. 32; O. Schei et al., "Alveolar Bone Loss as Related to Oral Hygiene and Age," Journal of Periodontology (January 1959), p. 7.

⁶Löe et al., "The Natural History of Periodontal Disease in Man," p. 550.

Hiep, Stallard and Shapiro⁷ noted from their investigation that large numbers of gram negative bacteria in the oral cavity produce endotoxins. They hypothesized that these endotoxins produce clinical signs of gingival inflammation. Their investigations supported the conclusion that the endotoxin production and enzyme activity of dental plaque varies. They also noted that toxicity can be significantly reduced by performing procedures that remove plaque from the gingiva.

Ramfjord et al.⁸ summarized a survey conducted in five countries that was sponsored by the World Health Organization. The findings revealed almost a 100 percent prevalence of periodontal disease in developing countries. Other findings indicated a strong association between the amount of dental plaque and calculus present and the severity of periodontal disease. Furthermore, no consistent relationship existed among periodontal status and sex race, and ethnic and nutritional status when persons of equal age and oral hygiene status were compared.

After examining the microbiological composition of dental plaque and the etiology of periodontal disease,

⁷N. Hiep, R. E. Stallard, and L. Shapiro, "Dental Plaque," Journal of Periodontology (February 1974), pp. 117, 122.

⁸Sigurd Ramfjord et al., "Epidemiological Studies of Periodontal Diseases," American Journal of Public Health (September 1968), p. 1722.

Socransky and others⁹ collectively concluded that there are no clear chemotherapeutic means to prevent periodontal disease other than by repeated removal of dental plaque. The results of an investigation by Kelner et al.¹⁰ also indicated that the most effective method of plaque removal available to date is mechanical disruption such as tooth-brushing and dental flossing. At this time, research indicates that the effective and frequent removal of dental plaque from the teeth and gingiva is the best method to reduce or prevent periodontal disease.¹¹

Indices Used to Assess Oral Hygiene and Oral Health Status

Research and treatment programs including prescribed home care plaque removal for individuals have demonstrated that dental plaque scores are particularly useful measures for evaluating client oral hygiene behaviors. Certain criteria are necessary to consider when choosing the

⁹S. S. Socransky, "Microbiology of Periodontal Disease--Present Status and Future Considerations," Journal of Periodontology (September 1977), pp. 497, 502; L. M. Lightner et al., "Preventive Periodontic Treatment Procedures: Results Over 46 Months," Journal of Periodontology (September 1971), p. 555; J. D. Suomi et al., "The Effect of Controlled Oral Hygiene Procedures on the Progression of Periodontal Disease in Adults: Results After Third and Final Year," Journal of Periodontology (March 1971), p. 152.

¹⁰R. M. Kelner et al., "Gingival Inflammation as Related to Frequency of Plaque Removal," Journal of Periodontology (May 1974), p. 303.

¹¹S. S. Socransky, p. 497; L. M. Lightner et al., ibid., p. 555; J. D. Suomi et al., p. 152; R. M. Kellner et al., p. 303.

method for assessing dental plaque. Carter and Barnes¹² suggested that an effective index should demonstrate its validity, measuring those things that it purports to measure and be sensitive enough to measure small degrees of change. An index should be reliable also. A high correlation of reliability or precision should be evident whether the index is applied by the same examiner or by different examiners. Other considerations for selecting an index as a measuring instrument is that the index should be simple to use, require few instruments for collecting measurements, and should be as free as possible of subjective interpretation.

Numerous methods for assessing dental plaque are available. Albino et al.¹³ compared the reliability of six plaque scoring methods used in a preventive dentistry program for seventh graders. The Kobayashi and Ash techniques for indexing oral hygiene status,¹⁴ the Martens and

¹²H. G. Carter and G. P. Barnes, "Gingival Bleeding Index," Journal of Periodontology (November 1974), p. 801.

¹³Judith E. Albino et al., "A Comparison of Six Plaque Scoring Methods for Assessing Oral Hygiene," Journal of Periodontology (August 1978), p. 419.

¹⁴L. Kobayashi and M. Ash, "A Clinical Evaluation of an Electric Toothbrush Used by Orthodontic Patients," Angle's Orthodontics (July 1964), p. 209.

Meskin technique,¹⁵ and the Evans technique,¹⁶ were compared and correlated on the basis of mean plaque scores of study subjects. The lowest correlations were obtained between scores based on surfaces selected from the whole mouth and those based on anterior surfaces only. These findings indicated that plaque score measures based on tooth surfaces selected from the entire mouth are the most valid in determining the oral hygiene status of individuals.

As Pilot¹⁷ pointed out in his investigation, when plaque assessment was carried out primarily for the purpose of providing feedback to the individual, scores taken from actual intraoral photographs were helpful in motivating clients to improve oral hygiene status. When assessments were conducted for the purpose of studying differences among groups of clients or treatments, reproducibility becomes extremely important. He suggested that reliable and valid indices be used to accurately formulate data for analysis and testing of hypotheses.

¹⁵L. V. Martens and L. H. Meskin, "An Innovative Technique for Assessing Oral Hygiene," Journal of Dentistry for Children (January-February), p. 12.

¹⁶H. L. Evans et al., "New Measures of Effects of Persuasive Communications: A Clinical Indicator for Tooth-brushing Behavior," Psychology Reports (December 1968), p. 731.

¹⁷T. Pilot, "A Reproducible Method of Evaluating Oral Hygiene," Journal of Periodontal Research (February 1968), p. 121.

Barrickman and Penhall¹⁸ investigated the use of graphing the results of plaque and gingival indices on the oral hygiene status of three groups of adult males. Results indicated that the use of charts and graphs noting the results of plaque and gingival index scores were helpful in improving the oral hygiene status of adult male subjects.

Löe¹⁹ and Ramfjord²⁰ reviewed numerous indices for evaluating oral hygiene status and measuring the extent of periodontal destruction. After review, Löe's Plaque Index²¹ (PI) and Carter and Barnes' Gingival Bleeding Index²² (GBI) were selected for use in the investigation (see Appendices A and B). This decision was based on the idea that the PI was developed to distinguish between the severity and location of soft deposits on the teeth without the use of disclosing agents. Although the presence of plaque on a tooth surface has been implicated in the etiology of gingival and periodontal disease, plaque indices relying on the staining of accumulated

¹⁸R. W. Barrickman and O. J. Penhall, "Graphing Indexes Reduces Plaque," Journal of the American Dental Association (December 1973), p. 1404.

¹⁹Löe, p. 610.

²⁰S. P. Ramfjord, "Indices for Prevalence and Incidence of Periodontal Disease," Journal of Periodontology (Vol. 30, 1959), p. 51-59.

²¹Löe, p. 610.

²²Carter and Barnes, p. 805.

materials on the tooth only imply that plaque is present and not necessarily that disease is present. The pathogenicity of dental plaque cannot be determined by disclosing agents.²³ This criterion is of particular importance in research because gingival bleeding is the first sign of gingival disease activity.²⁴

Gingival bleeding as an early indication of gingivitis and its sequela, periodontitis, has been studied by several authors, including Massler and Schour,²⁵ Løe,²⁶ and Muhlemann,²⁷ and Meitner et al.²⁸ In 1971, Muhlemann demonstrated that bleeding from the gingival sulcus was the earliest clinical sign of gingivitis and that it preceded discoloration and swelling of the gingival units.²⁹ Muhlemann's index score was determined by the amount of bleeding from the sulcus during probing and by

²³Carter and Barnes, p. 806.

²⁴H. R. Muhlemann and S. Son, "Gingival Sulcus Bleeding: A Leading Symptom in Initial Gingivitis," Helvetica Odontologica Acta (1971), p. 107.

²⁵M. Massler, et al., "Occurrence of Gingivitis in Suburban Chicago School Children," Journal of Periodontology (July 1950), p. 146.

²⁶H. Løe, "Gingival Index, the Plaque Index, and the Retention Index," Journal of Periodontology (June 1967), p. 38.

²⁷H. R. Muhlmann and S. Son, p. 107.

²⁸S. W. Meitner et al., "Identification of Inflamed Gingival Surfaces," Journal of Clinical Periodontology (April 1979), p. 93.

²⁹Muhlmann and Son, p. 107.

the clinical appearance of the marginal and papillary gingival units. Further support for bleeding as an early clinical sign of gingival disease has been provided by Lennox and Kopczyk³⁰ who noted that bleeding points do not correlate directly with inflammation but rather they precede signs of clinical inflammation. The investigations of Meitner and others³¹ also supported the effectiveness of gingival bleeding indices for the detection of early deviations from gingival health. Research data revealed that when healthy gingival surfaces (no inflammation and no bleeding) developed clinically detectable signs under investigation, a significantly greater number of subjects manifested bleeding alone compared to either visible inflammation alone or a combination of visible inflammation and bleeding.

Methods Used in Dental Disease Control

The majority of the research conducted on dental disease control has been on the comparison of various types of disclosing agents to aid in disease control.³² Investigations on the use of disclosing solutions and

³⁰J. A. Lennox and R. A. Kopczyk, "Clinical System for Scoring Patient's Oral Hygiene Performance," Journal of the American Dental Association (April 1973), p. 849.

³¹Meitner et al., p. 93.

³²C. Gallagher, "Mechanism of Action of a Two-Tone Plaque Disclosing Agent," Journal of Periodontology (July 1977), p. 395.

tablets to identify dental plaque accumulations have established that the agents serve as an effective aid in obtaining mean scores of plaque indices.³³

Research conducted on the use of disclosing agents to identify dental plaque was conclusive in providing an effective means to locate dental plaque more readily. Friedman et al.³⁴ found that erythrocin dye and fluorescein dye were equally effective in modifying oral hygiene behavior. Cohen et al.³⁵ compared the effectiveness of the use of two disclosing solutions by clients when used in conjunction with toothbrushing and compared the results with a control group of nondisclosing subjects. He found no significant difference in the type of solution used; however, the group using disclosing solution more effectively improved their oral hygiene status than did the control group. Raybin³⁶ perceived disclosants as a means of recognizing foreign matter in its incipiency. He stated that every client believes he is taking proper care of his teeth, but a disclosing solution will point out the true location of dental plaque deposits. He also stated

³³Ramfjord, p. 228.

³⁴L. A. Friedman et al., "Bacterial Plaque Disclosure Survey," Journal of Periodontology (June 1974), p. 439.

³⁵D. W. Cohen et al., "A Comparison of Bacterial Plaque Disclosing in Periodontal Disease," Journal of Periodontology (June 1972), p. 333.

³⁶M. Raybin, "Disclosing Solutions, Their Importance and Uses," Dental Outlook (April 1943), p. 157.

that the routine use of disclosants by clients was a revolutionary contribution to the dental profession. Arnim³⁷ found in his investigations that it was enlightening to clients to see their bacterial plaque by using a disclosing solution. Gillings³⁸ investigated the use of various types of disclosing solutions. His findings indicated that the two tone dye disclosants differentiated between newly formed and mature plaque deposits and had the additional advantage of making a dramatic impact on dental clients when used for dental disease control.

Research findings on the recognition of gingival bleeding as an indicator of disease and a need for dental clients to improve their oral hygiene are limited. In a study of the psychology of plaque control behavior, Godin³⁹ attempted to identify the relationship of visualization of dental needs in impressing the need for certain procedures. Clients were motivated to continue improving their oral health status when visualization of results of improved gingival color were available. Results of dental

³⁷S. S. Arnim, "The Use of Disclosing Agents for Measuring Tooth Cleanliness," Journal of Periodontology (May 1963), p. 227.

³⁸B. R. Gillings, "Recent Developments In Dental Plaque Disclosants," Australian Dental Journal (August 1977), p. 266.

³⁹M. C. Godin, "The Effect of Visual Feedback and Self-Scaling on Plaque Control Behavior," Journal of Periodontology (January 1976), p. 34.

disease control research conducted by Edwards⁴⁰ suggested that the Gingival Bleeding Index developed by Carter and Barnes is an excellent device to evaluate the efficiency of plaque control programs both for investigators and the clients. He also stated that the Gingival Bleeding Index appears to be an effective indicator that will facilitate a change from gingival inflammation toward gingival health. Studies by Saxer, Turconi and Elsasser⁴¹ indicated that patient motivation and education by means of a Papillary Bleeding Index was effective in a preventive dentistry program. Results of their investigation suggested that oral health motivation did not necessarily depend on plaque disclosing procedures. They proposed that demonstration of a symptom of disease, gingival bleeding, was more easily comprehensible by the dental client and should merit more attention as a diagnostic aid and stimulus toward better oral hygiene.

Summary

A multitude of literature exists on the prevalence and severity of gingival disease in the world population. This literature indicated that: (1) the distribution of

⁴⁰R. C. Edwards; "Bleeding Index--A New Indicator in Personal Plaque Control," Journal of the American Society for Preventive Dentistry (May-June 1975), p. 22.

⁴¹U. P. Saxer, B. Turconi, and C. Elsasser, "Patient Motivation With the Papillary Bleeding Index," Journal of Preventive Dentistry (July-August 1977), p. 22.

gingival and periodontal disease is universal; (2) there is an increase in the prevalence and the severity of gingival disease from childhood to old age; (3) gingivitis constitutes the initial lesion in periodontal disease, and although all gingival lesions may not progress to periodontitis, wherever periodontal breakdown has occurred it most likely has been preceded by gingivitis and bleeding; (4) some population groups have more periodontal disease and greater severity than others; and (5) the number of teeth lost due to periodontal diseases increases with advancing age.

The research available on the "traditional" approaches to controlling dental plaque by using disclosing agents was plentiful; literature on alternative approaches was somewhat limited. The purpose of this study was to investigate a "non-traditional" approach to controlling dental disease, the recognition of gingival bleeding by dental clients for improving their oral hygiene and oral health.

Chapter 3

METHODS AND MATERIALS

The purpose of this investigation was to examine and compare two different methods for identifying dental plaque accumulations and gingival disease to improve oral health and oral hygiene. The first method involved the use of disclosing tablets by subjects to reveal dental plaque deposits to control disease; the second method used was the recognition of gingival bleeding by subjects to control disease.

Sample Description

A convenience sample of 500 adults who had attended the Old Dominion University Dental Hygiene Clinic were randomly selected from the Clinic files. To be included in the sample, subjects must have

1. been between the ages of 18 and 60
2. had no oral prophylaxis within 6 months prior to January 26, 1980
3. had no previous periodontal therapy
4. had no periodontal pocket depths greater than 6mm
5. had no orthodontic appliances

6. at least fifteen natural teeth, including four molars

7. no mental or physical handicaps

8. no medical complexities, e.g. history of heart conditions, blood dyscrasias, diabetes, pregnancy, hormonal imbalance, or the use of anti-inflammatory drugs.

After preliminary screening of previous dental records and medical histories and subjects' consent to participate was obtained, a population of fifty subjects was initially selected for the study. Subjects were randomly assigned to one of two groups by the research assistant to insure group equivalence. A table of random numbers was used to aid in randomization. Sample bias might have existed due to the fact that clients of a dental hygiene clinic are actively seeking dental care and value their oral health.

Forty-two subjects ultimately participated in the study. Subject attrition occurred because of medical and dental complexities that were noted during verification of significant medical findings and the oral examination during the initial prophylaxis appointment (see Appendix A).

Research Design

The effectiveness of one independent variable, the use of disclosing tablets, was compared with the second independent variable, recognition of gingival bleeding, for improving oral hygiene and oral health status. The dependent variables, oral hygiene and oral health status, were measured by the quantitative scores obtained for each subject on the Plaque¹ and Gingival Bleeding² Indices at four appointments.

A randomized two group pretest-posttest design was employed to test the effectiveness of the two methods of controlling dental disease over a 75-day period (see Tables 1 and 2). The rationale for selecting this design was that it could measure change and control most of the extraneous variables that posed a threat to internal validity.³ The experiment was double blind to control for researcher bias.

Situation-relevant variables were controlled by standardization of the content and emotive nature of the dialogue between the clinicians and subjects (see

¹Harold G. Carter and George P. Barnes, "The Gingival Bleeding Index," Journal of Periodontology (November 1974), p. 801.

²H. L oe, "The Gingival Index, the Plaque Index, and the Retention Index Systems," Journal of Periodontology (June 1967), p. 610.

³D. Ary, L. C. Jacobs, and A. Rasavieh, Introduction to Research Education, 2nd ed. (New York: Holt, Rinehart, and Winston, 1979), p. 338.

Table 1

Randomized Groups, Pretest-Posttest Design (Plaque Index Scores)*

| Group | Pretest | Independent Variable | Posttest 1 | Posttest 2 | Posttest 3 |
|-------|----------------------|--|--|--|--|
| (R) A | Y_1 (PI Scores) | X_1 (Disclosing Tablets) | Y_2 (PI Scores) | Y_3 (PI Scores) | Y_4 (PI Scores) |
| (R) B | Y_1 (PI Scores) | X_2 (Signs of Gingival Bleeding) | Y_2 (PI Scores) 3 wks after prophylaxis | Y_3 (PI Scores) 1.5 mos after prophylaxis | Y_4 (PI Scores) 2.5 mos after prophylaxis |

Key: X = independent variables

Y = represents the measure of the dependent variable.

Y_1 represents the dependent variable before the manipulation of the independent variable X; Y_2 , Y_3 , Y_4 represents the dependent variable after the manipulation of the independent variable X.

R = indicates random assignment of subjects to experimental groups and the random assignment of treatments to the groups.

A = refers to group using disclosing tablets.

B = refers to group recognizing signs of gingival bleeding.

*Ary, p. 251.

Table 2

Randomized Groups, Pretest-Posttest Design (Gingival Bleeding Index Scores)*

| Group | Pretest | Independent Variable | Posttest 1 | Posttest 2 | Posttest 3 |
|-------|--------------------------------|--|--|--|--|
| (R) A | Y ₁ (GBI Scores) | X ₁ (Disclosing Tablets) | Y ₂ (GBI Scores) | Y ₃ (GBI Scores) | Y ₄ (GBI Scores) |
| (R) B | Y ₁ (GBI Scores) | X ₂ (Signs of Gingival Bleeding) | Y ₂ (GBI Scores) 3 wks after prophylaxis | Y ₃ (GBI Scores) 1.5 mos after prophylaxis | Y ₄ (GBI Scores) 2.5 mos a prophylaxis |

Key: X = independent variable

Y = represents the measure of the dependent variable.
Y₁ represents the dependent variable before the manipulation of the independent variable X; Y₂, Y₃, and Y₄ represent the dependent variable after the manipulation of the independent variable X.

R = indicates random assignment of subjects to experimental groups and the random assignment of treatments to the groups.

A = refers to group using disclosing tablets.

B = refers to group recognizing signs of gingival bleeding.

*Ary, p. 251

Appendix B); an orientation for clinicians was conducted to aid in controlling situation-relevant variables (see Appendix C). Environmental conditions during data collection were controlled by using the same dental unit, light intensity, patient position, examiner position, and armamentaria.

The principal investigator executed all scoring procedures. All dental disease control instructions were presented on videotape to aid in further standardization.

The use of the baseline scores, an essential feature of the design, might have sensitized the clients to the purpose of the experiment. Generalization of results, therefore, will be most valid when applied to similarly pretested populations.

Methodology

All research was conducted at the Old Dominion University Dental Hygiene Clinic. Fifty subjects were randomly assigned to one of two groups:

1. Group A--was taught to use disclosing tablets to identify the accumulation of dental plaque in order to identify areas in need of further cleansing.
2. Group B--was taught to identify areas of gingival bleeding as an indication of the presence of dental plaque retention in order to identify areas in need of further cleansing.

A schedule of treatment procedures in the sequence of delivery is summarized as follows:

Initial Appointment

1. Prior to arriving at the Old Dominion University Dental Hygiene Clinic for screening, the clients had completed and returned a medical history and an initial consent form (see Appendix C). Clients indicating medical complexities contraindicating treatment procedures were excluded from the sample population.

2. At the first appointment each client was examined with a mouth mirror (Hu Freidy #4) and a compressed air syringe to determine eligibility as a subject. A Gingival Bleeding Index Score and a Plaque Index score was taken on each subject deemed acceptable for the investigation. The scores were obtained to assess the baseline oral health and oral hygiene status of each subject. A research assistant seated opposite the principal investigator recorded the data on the appropriate chart (see Appendices D and E). After the scoring procedure was completed, clients deemed eligible were appointed to return approximately one week later for a prophylaxis appointment.

3. Random assignment of subjects to one of two experimental groups by the research assistant was completed after the initial screening appointment.

4. At the beginning of the prophylaxis appointment, subjects in both groups were given a brief videotaped presentation about the control and prevention of dental disease. The presentation included a short explanation of the nature of dental plaque, the relationship of plaque to dental disease, and the necessity of frequent plaque removal (see Appendix F).

5. Next, the subjects were moved into separate classrooms, according to group assignment, to view similar eight minute films.⁴ The films were identical in the explanation of periodontal disease, its course and its progression. The relationship of bacteria to periodontal disease and the importance of dental plaque removal for prevention and control of dental disease was stressed. The proper technique for using dental floss and the toothbrush to remove dental plaque was demonstrated in the films. The films differed primarily in the method demonstrated to reveal dental plaque deposits. The film viewed by Group A demonstrated the use of disclosing tablets to reveal areas of the mouth to be cleaned. Group B viewed a film that demonstrated the recognition of gingival bleeding as an indication of areas that need to be cleaned.

⁴American Dental Association, "An Oral Hygiene Program and Periodontal Disease," American Dental Association Catalog 1979-80 (Chicago: American Dental Association, 1979), p. 35.

6. After viewing the film, subjects in Group A were instructed in the use of disclosing tablets to reveal dental plaque deposits and were instructed to examine their mouth with a mouth mirror to see if areas of plaque remained after brushing and flossing. If areas of plaque were noted, subjects were instructed to repeat the oral hygiene procedures to remove the dental plaque deposits in those areas. After viewing the film, Group B subjects were instructed in the use of the toothbrush and dental floss, using signs of gingival bleeding as an indicator of areas not properly cleansed. If areas of gingival bleeding were noted, they were instructed to repeat the oral hygiene procedures (brushing and flossing) in the areas.

7. The subjects were then directed to the Dental Hygiene Clinic for their prophylaxis appointment.

Prophylaxis Appointment(s)

Immediately following the oral health education session, the subjects individually received an oral prophylaxis at the Dental Hygiene Clinic. Student dental hygienists rendered the oral prophylaxes, as specified in Appendix C. The student dental hygienists updated the medical history, performed an oral examination (intraoral and extraoral), took dental radiographs if indicated, removed any hard deposits from the teeth, cleansed and polished the teeth, and administered a topical fluoride

treatment if indicated. The prophylaxis procedure was planned to take one or two three-hour appointments. After completion of the prophylaxes, the subjects received a letter discussing the subsequent appointment procedures and an appointment card scheduling their next three appointments (see Appendix G).

First Follow-up Appointment (three weeks after the prophylaxis procedure was completed):

1. This appointment included a brief review of self-care procedures for subjects. The subjects were scored using the Plaque and Gingival Bleeding Indices and dismissed.

2. The scores obtained for each subject were used for comparison with subsequent Plaque Index and Gingival Bleeding Index scores.

3. The principal investigator performed all scoring procedures under the supervision of a licensed dentist.

Second Follow-up Appointment (one and a half months after the prophylaxis had been completed):

1. Plaque Index and Gingival Bleeding Index scores were taken on each patient.

2. The patients were dismissed after the scoring procedure was completed.

Final Follow-up Appointment (two and a half months after the prophylaxis was completed):

1. A fourth Plaque Index and Gingival Bleeding Index measurement was obtained and a debriefing and follow-up letter were presented to each subject at this appointment (see Appendix H).

2. Results of the study were made available to the subjects several months after the completion of the last appointment.

Instrumentation

The instruments used for data collection were the Plaque Index (PI) developed by Løe⁵ and the Gingival Bleeding Index (GBI) developed by Carter and Barnes.⁶ The data from the indices were ratio scaled. The Gingival Bleeding Index and the Plaque Index have been shown to possess content validity as measuring instruments of gingival condition and plaque retention, respectively.⁷

The Plaque Index was developed for the purpose of distinguishing between the severity and location of the soft debris aggregates.⁸ Each of the four gingival areas

⁵Løe, p. 611.

⁶Carter and Barnes, p. 802.

⁷Løe, p. 611; Carter and Barnes, p. 803.

⁸Løe, *ibid.*; J. Silness and H. Løe, "Periodontal Disease in Pregnancy. II. Correlation Between Oral Hygiene and Periodontal Condition," Acta Odontologica Scandinavica (Vol. 22, 1966), p. 112.

of the tooth were given a score from 0-3; this score was the Plaque Index for the area. The scores from the four areas of the tooth were averaged to give the mean Plaque Index score for the tooth. The mean scores of all teeth were averaged to determine the overall Plaque Index score for the individual.

Specific criteria for the Plaque Index are:⁹

1. PI = 0. This score is given when the gingival area of the tooth surface is literally free of plaque. The surface is tested by running a periodontal probe (Hu-Freidly #12) across the tooth surface at the entrance of the gingival crevice after the tooth has been properly dried. If no soft matter adheres to the point of the probe, the area is considered clean.
2. PI = 1. This score is given when no plaque can be observed in situ by the unaided eye. When examined with a periodontal probe, the plaque is made visible on the point of the probe after it has been moved across the tooth surface at the entrance of the gingival crevice. For the purpose of this investigation, no disclosing solution was used in the scoring procedure.
3. PI = 2. This scoring is given when the gingival area is covered with a thin to moderately thick layer of plaque. The deposit is visible to the unaided eye.
4. PI = 3. Heavy accumulation of soft matter approximately 1-2 mm thick are visible on the tooth surface. The interdental area is filled with soft debris. The assessment of plaque on crowns, restoration, and calculus deposits is scored.¹⁰

⁹Löe, *ibid.*

¹⁰*Ibid.*, p. 615.

The Plaque Index scores consider differences in the thickness of the soft deposit in the gingival area of the tooth. The coronal extension of plaque is not considered in the scoring procedure.¹¹

The Plaque Index may be scored for all surfaces of the tooth, selected teeth, or selected areas of the teeth. For the purpose of this investigation, teeth numbers 3, 6, 8, 9, 11, 14, 22, 24, 25, 27, and 30 were selected for scoring purposes. If the specified tooth was not present, an adjacent tooth was scored. If no adjacent tooth was present, no score was recorded. The sequence of examination of surfaces began buccally with tooth #3 and proceeded to the left side of the mouth until the buccal surface of tooth #14 was scored. The scoring proceeded lingually from tooth #14 to tooth #3. The same procedure was used on the mandibular arch, beginning with tooth #19 and proceeding to tooth #30. Scoring for the Plaque Index system required an overhead dental unit light, a compressed air syringe for drying the teeth and gingiva, a mirror, and a periodontal probe (Hu-Friedy #12).

If optimal conditions and chairside assistance were provided, and all indicated teeth were examined, the scoring procedure required approximately five minutes.

¹¹Ibid., p. 615.

Since both the PI and GBI indices were used, assessment of the PI preceded that of the GBI.¹²

The Gingival Bleeding Index¹³ records the presence or absence of gingival inflammation as determined by bleeding from interproximal gingival sulci. All interproximal areas having a mesial and distal crevice component were considered to be susceptible to gingival inflammation and these areas were recorded as total areas at risk. Although the interdental area involves two crevices, they were scored as one interdental unit. A clinician may desire to score each crevice individually, but for most evaluative observations this additional quantification has not been necessary. Areas involving third molars were not scored because of variations in position, access, and vision. Other areas were also classified as nonscoreable when tooth position, diastemas, or other factors compromised the desirable interproximal relationships.

Unwaxed dental floss was used as an instrument because it is readily available, is disposable, and can easily be used by the instructed client for self-evaluation. Unlike the periodontal probe, the floss provided a means of quickly evaluating a large area of the crevice. To score a susceptible area, the unwaxed dental floss was passed interproximally into the gingival

¹²Löe, p. 611.

¹³Carter and Barnes, p. 803.

crevice on both sides of the interdental papilla, with the floss extended as far as possible towards the buccal and lingual surface. The floss was carried to the bottom of the crevice as far as possible. The floss was moved in an inciso-gingival motion for one double stroke. Care was taken to avoid laceration of the interdental papillae and a new length of clean floss was used for each interproximal unit.

The teeth were divided into six segments and they were flossed in the following sequence: maxillary posterior right, maxillary anterior, maxillary posterior left, mandibular posterior left, mandibular anterior, and mandibular posterior right. The examiner retracted the cheek during the application of the floss and direct vision was used to identify areas of hemorrhage from both the buccal and lingual surfaces.

Bleeding will be immediately evident in the area or on the floss; however, thirty seconds was allowed for reinspection of each segment. The degree of bleeding was not determined; only the presence or absence of bleeding was noted. Bleeding from one unit into adjacent scoreable areas was not a problem. If copious hemorrhage tended to mask other areas, the client was allowed to rinse his/her oral cavity between scoring segments. By applying the floss to each interproximal area with controlled pressure, the same digital technique and

chair position, the examiner was able to replicate the procedure for each patient.

For each subject a Gingival Bleeding score was obtained by noting the total units (areas) of bleeding gingiva and the total number of areas at risk. A gingival unit consisted of one papilla between two teeth. For the purpose of this investigation the total health status of each individual was reviewed and considered prior to treatment. An average of 26 units of papillary gingival tissue were examined in approximately three minutes. No attempt was made to qualify the degree of bleeding; only the absence or presence of bleeding for each gingival unit was recorded.

In clinical studies involving large groups, examiner fatigue could become a problem. Examination of approximately 12 patients an hour with a maximum of four hours for a daily schedule was used to avoid examiner fatigue. The hours of examination procedures were divided into morning and afternoon sessions.

Materials

Materials and equipment used throughout this investigation are listed as follows:

1. Plaque Index scoring charts and Gingival Bleeding Index scoring charts (see Appendices D and E)
2. Front surface mouth mirrors (Hu Friedy #4)
3. Periodontal probes (Hu Friedy #12)

4. Clinical supplies including patient napkins, headrest and tray covers, paper towels, and disposable latex gloves.

Treatment setting was the same during all scoring procedures. For examination, subjects were placed in a supine position with the back of the chair parallel to the floor and the subject's feet elevated slightly higher than the head. A Ritter dental unit with attached overhead light was used for the examination procedure.

The subjects in Group A were instructed to follow the prescribed home care instructions using the toothbrush, dental floss, and disclosing tablets provided; Group B subjects were instructed to follow the prescribed home care procedures using the toothbrush, dental floss, and mouth mirror provided (see Appendix I). Instead of using disclosing tablets to reveal plaque, Group B subjects were instructed to look for gingival bleeding as an indicator of plaque retention and disease. Equipment used during the oral health education session included a projection screen, a 16mm film projector, and a video-cassette player and monitor.

Prophylaxis Procedures

1. Instruments used by student clinicians during prophylaxis procedures included a Columbia 13/14 curet, a Gracey 11/12 and 13/14 curet, an ODU S33 sickle scaler, a Hu Friedy #4 front surface mirror, and a #23 explorer

CH3 explorer, snap-on prophylaxis angle, rubber polishing cup, tapered prophylaxis brushes, and a pumice cup.

2. Clinical supplies included: patient napkins, headrest and tray covers, cotton tip applicators, 2 inch X 2 inch gauze squares, disposable saliva ejectors, Nupro coarse grit prophylaxis paste (fluoridated), topical fluoride solution, and styrofoam fluoride trays, Johnson and Johnson dental floss (unwaxed), and surface disinfectant.

3. Initial experiment treatment setting was similar for each subject during the prophylaxis procedure. Dental units with attached lights were used for the prophylaxis procedure.

Statistical Treatment

A computerized statistical biomedical package, BMD-P2V¹⁴ was used to analyze data for hypothesis testing. The t-test was employed to analyze data to determine if an initial difference existed between group means based on the pretest measures. An analysis of variance for repeated measures was used to determine whether a significant difference at the 0.05 level existed between the mean Plaque Index and Gingival Bleeding Index scores for Group A and Group B.

¹⁴BMD-P2V, Analysis of Variance and Covariance Including Repeated Measures, University of California, Los Angeles.

Protection of Human Subjects

Prior to initiation of this study, the principal investigator submitted to the Old Dominion University Review Board for the Protection of Human Subjects the following proposal for the protection of subjects in the investigation:

1. Subject Population--The proposed research required the utilization of 42 adult subjects between the ages of 18 and 60. The subjects were selected from the client population of the Old Dominion University Dental Hygiene Clinic. Subjects had to be free from any mental disabilities or physical handicaps that could have interfered with their ability to give voluntary informed consent for participation in the study (see Appendix J). No clients were accepted in the sample population who manifested any medical complexities, severe periodontal destruction or orthodontic appliances.

2. Potential Risks--One potential risk involved was the possibility of causing a bacteremia during the oral prophylaxis. This risk was minimized by taking a detailed medical history on each subject prior to treatment (see Appendix K). All clients with medical complexities that contraindicated subgingival instrumentation without proper prophylactic premedication were excluded from the investigation.

Another potential risk considered in this investigation was the possibility of puncturing the epithelial

attachment of the gingiva through instrumentation with the periodontal probe. The possibility of this risk was minimized by allowing the principal investigator to perform the instrumentation procedure. The principal investigator was a registered dental hygienist who was trained and experienced in proper instrumentation techniques.

The second-year student dental hygienists who rendered the oral prophylaxes to the subjects were properly supervised by the Dental Hygiene faculty while rendering the oral prophylaxis procedure to minimize potential risk to the subjects. The prophylaxis procedures were conducted in a closely supervised and relaxed manner to minimize stress and discomfort to the subject.

3. Consent Procedures--At the first visit, a complete explanation of the investigation's purpose, procedures, and potential risks was presented to the subjects involved in the study. Voluntary informed consent was obtained after the subject expressed a desire to participate in the investigation. Subjects were informed that they could withdraw from the experiment at any time without threat of penalty. Subjects were not denied further treatment at the Old Dominion University Dental Hygiene Clinic if they discontinued participation in the experiment.

4. Protection of Subject's Rights--Confidentiality of subjects' records and individual performance throughout the investigation were maintained. Subjects were

identified by number rather than by name. All data were regarded as confidential by the principal investigator and other individuals involved in the study. No data were released without written request of the subject. Subjects were informed at the beginning of the investigation that oral or written presentation of the results would be presented in group form only. Upon completion of the study, all subjects were debriefed. The results of the research were mailed to the subjects after the data were analyzed.

5. Potential Benefits to the Subjects--Subjects benefited from the preventive oral hygiene services received during the study. Services were provided at no charge to the subjects. The subjects also benefited from the knowledge obtained as a result of the study.

6. Analysis of Risk-Benefit Ratio--The benefits that the subjects might obtain from participation in the investigation were an anticipated improvement in the dental health status and oral hygiene behavior. The benefits of improvement of the subject's dental health overcame the potential risk factors.

Chapter 4

RESULTS AND DISCUSSION

Fifty adults between the ages of 18 and 60 years of age were selected from the files of clients who had attended the Old Dominion University Dental Hygiene Clinic previously for preventive services. Each adult was randomly assigned to one of two groups. One group (Group A) was taught to use disclosing tablets to identify dental plaque accumulation and to aid in improving their oral health and oral hygiene status. The other group (Group B) was taught to recognize signs of gingival bleeding as an indication of areas of dental plaque accumulation and to aid in improving their oral health and oral hygiene status. Over a 75-day period the oral hygiene and oral health status of each adult client was measured to determine the effectiveness of the two methods of dental disease control used. In a series of four appointments conducted at prescribed intervals, the oral health of each client was measured using the Gingival Bleeding Index; the oral hygiene status of each client was measured using the Plaque Index. Prior to receiving an oral prophylaxis, baseline measurements of the oral health and oral hygiene status of each client were collected. Four subjects from

each group were dismissed from the study because of medical complexities that were noted during the verification of significant medical findings and because of periodontal involvement (pocket depths greater than 6mm) during this appointment. After the data were collected, each client received an oral prophylaxis. Appointments were conducted at intervals of three weeks, one and a half months, and two and a half months after the prophylaxis. An analysis of variance for repeated measures was employed to test the null hypotheses. Data analysis was used to determine the main and interaction effects of the independent variable, method of disease control used, on the dependent variables, oral hygiene status and oral health status, as measured by Plaque Index scores and Gingival Bleeding Index scores, respectively at each appointment.

Results

Data were first examined using a t-test for independent samples to determine if an initial difference existed in the oral health and oral hygiene status of the two groups. Analysis of the baseline oral hygiene scores revealed no statistically significant difference in the mean Gingival Bleeding Index scores of Group A and Group B (Appointment I: $t\text{-value} = 0.1346$, $df = 40$, $p > 0.05$ (see Table 3). A t-test for independent samples revealed no statistically significant difference in the Plaque Index scores of Group A and Group B (Appointment I):

Table 3

t-Test Value of Mean GBI Scores of Subjects in Groups A and B
(Appointment I)

| Group | n | \bar{x} | sd | t-value |
|--|----|-----------|--------|---------|
| A (Using Disclosing Tablets) | 21 | 0.1788 | 0.1336 | 0.1346 |
| B (Recognizing Signs of Gingival Bleeding) | 21 | 0.1761 | 0.1620 | |

df = 40, $p > 0.05$

Standard Error 0.0199

t-value = 0.6303, $df = 40$, $p > 0.05$) (see Table 4). This inferred that there was initial group equivalence between Group A and Group B in oral health and oral hygiene status prior to introducing the independent variable, method of disease control used.

Data were analyzed to determine the main and interaction effects of the method of disease control used on the oral health status of clients in Group A and in Group B as measured by the Gingival Bleeding Index. Analysis of data revealed that the observed mean differences between the GBI scores of Group A and Group B (at Appointments I-IV) were statistically significant at the 0.05 level ($F = 3.93$, $df = 1$, $p = 0.054$) (see Table 5). Therefore, the null hypothesis was rejected. The method of dental disease control used by Group B was more effective for improving the oral health status of subjects in Group B than the method used by subjects in Group A. Data revealed no interaction between GBI scores for Group A and Group B ($F = 1.67$, $df = 3$, $p = 0.176$) (see Table 5).

Data were also examined to determine the main and interaction effects of the method of disease control used on the oral hygiene status of clients in Group A and Group B as measured by the Plaque Index. Analysis of data revealed that the observed mean differences between the PI scores of Group A and Group B (Appointments I-IV) were not statistically significant ($F = 0.19$, $df = 1$, $p = 0.661$)

Table 4

t-Test Value of Mean PI Scores of Subjects in Groups A and B
(Appointment I)

| Group | n | \bar{x} | sd | t-value |
|--|----|-----------|--------|---------|
| A (Using Disclosing Tablets) | 21 | 0.5694 | 0.2475 | 0.6303 |
| B (Recognizing Signs of Gingival Bleeding) | 21 | 0.5181 | 0.2871 | |

df = 40, $p > 0.05$

Standard Error 0.0815

Table 5
 Repeated Measures Analysis of Variance for Gingival Bleeding Index
 (Appointments I-IV)

| Source of Variance | SS | df | MS | F | Level of Sign. | p |
|--|---------|-----|---------|----------|----------------|--------|
| Group | 0.13166 | 1 | 0.13166 | 3.93126 | 0.05 | 0.054* |
| Subject by Group (Error for Testing Differences Between Groups) | 1.33964 | 40 | 0.03349 | | | |
| GBI Scores (Oral Health) | 0.31527 | 3 | 0.10509 | 12.12584 | 0.05 | < 0.05 |
| GBI Scores by Group (Oral Health by Group) | 0.04359 | 3 | 0.01453 | 1.67646 | 0.05 | 0.176 |
| GBI Scores by Subject by Group (Error for Training Differences Between GBI Scores and Interaction Between GBI Scores by Group) | 1.04000 | 120 | 0.00867 | | | |

*Denotes significance

(see Table 6). Therefore, the second null hypothesis was retained. Data revealed no interaction between PI scores for Group A and Group B ($F=1.78$, $df=120$, $p = 0.154$) (see Table 6).

Figure 1 indicates that the mean GBI scores of Group B were significantly lower than the mean GBI scores of Group A, indicating that the method of disease control used by Group B (recognizing signs of gingival bleeding) was significantly more effective in improving the oral health of those clients than the method used by Group A (using disclosing tablets) (see Table 7). Although, there was no statistically significant difference in the mean PI scores of clients in Group A and Group B, observation of Figure 2 indicates that the PI scores of Group A were slightly lower, suggesting an improvement in the oral hygiene of subjects in Group A (see Table 7).

Discussion

Data analysis for the first hypothesis at each of the appointments indicated that there was a statistically significant improvement in the oral health status of adult clients who recognized signs of gingival bleeding to aid in revealing dental plaque accumulations as compared with those clients who used disclosing tablets to aid in revealing dental plaque accumulations for improving oral health over a 75-day period. Data tend to support the hypothesis that over a 75-day period, recognizing signs of gingival

Table 6
 Repeated Measures Analysis of Variance for Plaque Index Scores
 (Appointments I-IV)

| Source of Variance | SS | df | MS | F | Level of Sign. | p |
|--|---------|-----|---------|----------|----------------|-------|
| Group | 0.02323 | 1 | 0.02323 | 0.19516 | 0.05 | 0.661 |
| Subject--by Group (Error for Testing Differences Between Groups) | 4.76117 | 40 | 0.11903 | | | |
| PI Scores (Oral Hygiene) | 1.21882 | 3 | 0.40627 | 12.61300 | 0.05 | <0.05 |
| PI Scores by Group (Oral Hygiene By Group) | 0.17243 | 3 | 0.0547 | 1.78443 | 0.05 | 0.154 |
| PI Scores by Subject By Group (Error for Testing Differences Between PI Scores and Interaction Between PI Scores by Group) | 3.86527 | 120 | 0.0321 | | | |

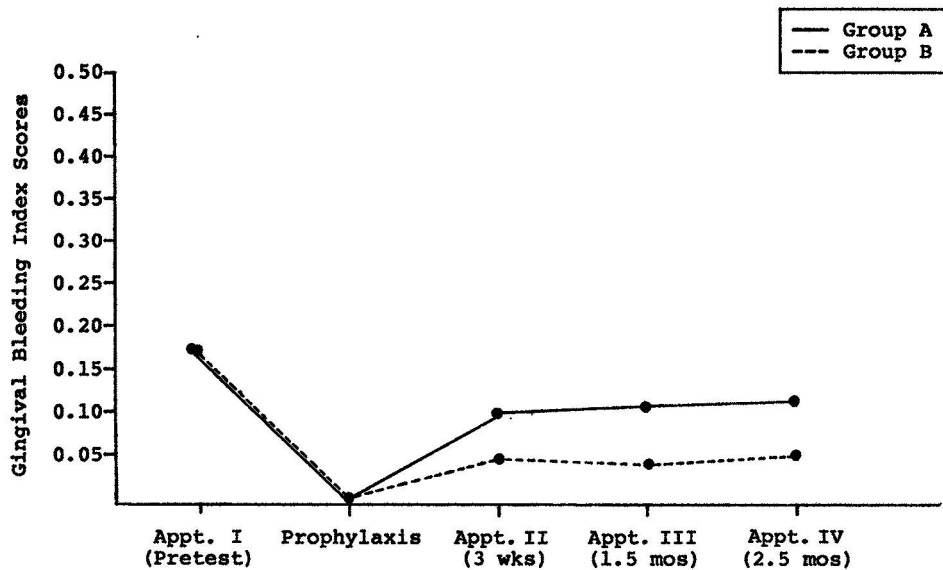


Fig. 1. Comparison of mean GBI scores for Group A and Group B at each appointment.

Table 7

Summary Statistics of PI and GBI Scores for the
Treatment Groups at Appointments I-IV

| | Group A | | | Group B | | |
|-------------------------------|-----------|-----------|---------|-----------|-----------|---------|
| | Appt. No. | \bar{x} | sd | Appt. No. | \bar{x} | sd |
| Plaque Index | I | 0.56945 | 0.25437 | I | 0.55377 | 0.28412 |
| | II | 0.42361 | 0.17949 | II | 0.45351 | 0.25338 |
| | III | 0.30556 | 0.16644 | III | 0.43006 | 0.28858 |
| | IV | 0.36410 | 0.17869 | IV | 0.31945 | 0.21684 |
| | Overall | 0.41568 | | Overall | 0.43920 | |
| Gingival Bleeding Index | I | 0.17886 | 0.13365 | I | 0.17617 | 0.16200 |
| | II | 0.10151 | 0.13476 | II | 0.04282 | 0.04691 |
| | III | 0.11632 | 0.15464 | III | 0.03843 | 0.05159 |
| | IV | 0.12671 | 0.15302 | IV | 0.04202 | 0.06725 |
| | Overall | 0.13085 | | Overall | 0.07486 | |

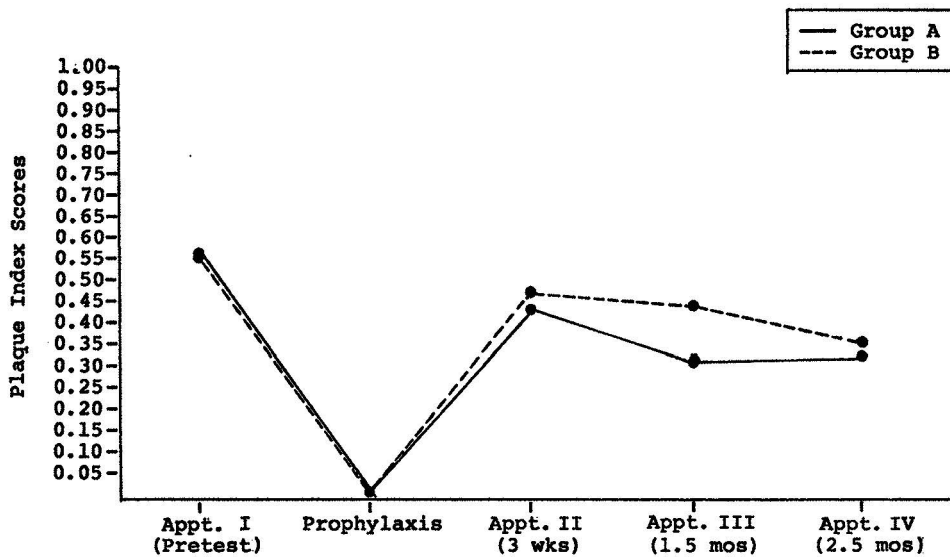


Fig. 2. Comparison of mean PI scores for Group A and Group B at each appointment.

bleeding to improve oral health is more effective in improving oral health than the use of disclosing tablets. The results are supported by the findings of Carter and Barnes¹ who indicate that the use of the Gingival Bleeding Index (thus, recognizing signs of gingival bleeding) may be as effective as the use of disclosing agents for improving the oral health of dental clients. Carter and Barnes argue that the presence of dental plaque on the tooth surfaces does not necessarily indicate the presence or absence of dental disease when factors such as microbial pathogenicity and host resistance are considered. Carter and Barnes' research support the idea that Muhlemann and Son² demonstrated when they found that bleeding from the gingival sulcus was the earliest clinical sign of gingivitis and preceded discoloration and swelling of the gingival units. With such limited findings on the subject of dental disease control through the use of signs of gingival bleeding and with such an abundance of data supporting the use of disclosing tablets to control dental disease, additional research on the use of signs of gingival bleeding by the client to control dental disease is needed.

¹Harold G. Carter and George P. Barnes, "The Gingival Bleeding Index," Journal of Periodontology (June 1972), p. 803.

²H. R. Muhlemann and S. Son, "Gingival Sulcus Bleeding: A Leading Symptom in Initial Gingivitis," Helvetica Odontologica Acta (October 1971), p. 107.

Although data analysis for the second hypothesis failed to reject the null hypothesis because no statistically significant difference existed between the Plaque Index scores of Group A and Group B, subjects in both groups exhibited improved mean PI scores between Appointment I and Appointment IV. This improvement in PI scores might have been due to the prophylaxis treatment, to the reinforcement of home care procedures at the first appointment, or to subtle behavioral changes in subjects as a result of periodic oral evaluations at the Dental Hygiene Clinic over the 75-day period of the study. The periodic oral evaluations probably influenced and motivated the subjects to practice improved home care procedures.

Prior to treatment, the oral health status and oral hygiene status of subjects in Group A and Group B were equivalent. The mean GBI scores from Group B improved from Appointment I through Appointment III and increased slightly from Appointment III to Appointment IV. The mean GBI scores of Group A improved from Appointment I to Appointment II and increased slightly at Appointments III and IV. The mean GBI scores for both groups at Appointment IV were significantly lower than the baseline data gathered at Appointment I. This trend needs to be observed over a longer period of time before definite conclusions can be made on the long term effectiveness of using signs of gingival bleeding as an aid in improving the oral health of adult dental clients.

The mean PI scores of subjects in Group A and Group B from Appointment I to Appointment II were slightly lower, indicating improved oral hygiene status for both groups (see Figure 2, p. 61). The mean PI score continued to improve from Appointment II to Appointment III; the mean PI scores of subjects in Group A improved slightly more than the PI scores of subjects in Group B. The mean PI scores of Group B increased slightly from Appointment III to Appointment IV, indicating a decline in the oral hygiene status of subjects in Group B. The mean PI scores of both groups at Appointment IV remained slightly lower, indicating an improvement from the baseline scores recorded at Appointment I. The initial decrease in the mean PI scores of Group A and Group B at Appointments II and III and the slight decrease in PI scores from the initial data collection to Appointment IV could be attributed to the reinforcement of dental disease control instructions given to the subjects at Appointment I. The slight increase in the mean PI scores for both groups between Appointment III and Appointment IV could be attributed to the fact that no additional reinforcement of disease control instructions was given after Appointment I. Perhaps subjects were less motivated to continue improved home care instructions at the conclusion of the study than at the beginning.

The limitations of the study should be addressed when interpreting the results. The fact that all subjects

participating in the investigation volunteered for the study might have had an effect on relating the sample findings to the population at large since these clients were actively seeking dental care and were probably more motivated to practice preventive dental behaviors.

Subjects participating in the study had previously received preventive dental hygiene services at the Dental Hygiene Clinic. These subjects were probably more motivated, better educated about preventive oral hygiene, and more interested in their oral health and oral hygiene status than clients who never seek preventive dental care. Subjects also might have been sensitized to improve their home care procedures and to practice preventive oral hygiene more during the time of the investigation.

Characteristics of the sample population (see Appendix P) might have influenced the findings of this investigation. More female subjects than male subjects were in both groups. Research has shown that females tend to have better oral health than males of the same age.³ The variable, sex, could have been controlled by randomly matching males and females in both of the groups.

³L. W. Ripa, "Correlations Between Oral Hygiene Status, Gingival Health, and Dental Caries in School Children," Journal of Preventive Dentistry (May-June 1974), p. 29.

Another limitation that might have influenced the findings of this investigation was that the intrarater reliability of the principal investigator was established approximately one month prior to the initiation of the study. Establishing intrarater reliability closer to the time of the investigation might have been more valid and reliable. The intrarater reliability of the principal investigator was only established for the Plaque Index, however, since the Gingival Bleeding Index is not immediately reproducible (see Appendix Q).

The last limitation to be considered was the length of time of the investigation. The 75-day period used for this investigation might not have been sufficient to detect a statistically significant difference between the oral hygiene status of subjects in Group A and Group B. The study should be continued to examine the Plaque Index and Gingival Bleeding Index scores of adult dental clients over a period of time equivalent to the average recall interval of six months.

Chapter 5

SUMMARY AND CONCLUSIONS

A multitude of research data exists on the nature and prevalence of dental disease and on the methods for prevention and control of dental disease.¹ Moreover, attempts have been made by dental professionals to improve the dental disease control practices of adults. A "traditional" approach to dental disease control involves the use of disclosing tablets to aid in the identification of areas of dental plaque accumulation. Investigations have proved this approach to be effective in improving oral health and oral hygiene when practiced regularly.²

¹E. F. Allen, "Statistical Study of the Primary Causes of Extraction," Journal of Dental Research (December 1944), p. 453; P. J. Brekhuis, "Dental Disease and Its Relation to the Loss of Human Teeth," Journal of the American Dental Association (December 1929), p. 2237; R. J. Gibbons and J. Van Houte, "On the Formation of Dental Plaques," Journal of Periodontology (June 1973), p. 347; J. L. Henry and J. C. Sinkford, "The Economic and Social Impact on Periodontal Disease," Public Health Reports (March-April 1979), p. 172.

²H. Løe, E. Theilade, and S. B. Jensen, "Experimental Gingivitis In Man," Journal of Periodontology (May-June 1965), p. 177; A. A. Lovdal et al., "Incidence of Clinical Manifestations of Periodontal Disease in Light of Oral Hygiene and Calculus Formation," Journal of the American Dental Association (January 1958), p. 21.

The "traditional" approach is based on the idea that the presence of dental plaque on the teeth is directly proportional to the amount of dental disease present.³ Disclosing agents stain only the dental plaque that adheres to the tooth surfaces and collects around the gingiva. This action merely implies that dental plaque is present. The pathogenicity of dental plaque cannot be determined by stain.⁴ However, measurement of a clinical sign, like bleeding, is a visual and concrete indication of disease activity. Researchers have demonstrated that gingival bleeding is an early indication of gingivitis and periodontitis.⁵ Bleeding from the gingival sulcus is the earliest clinical sign of gingivitis, preceding discoloration and swelling.⁶ These research findings were the basis for the development and implementation of this investigation.

³A. A. Lovdal et al., "Incidence of Clinical Manifestations of Periodontal Disease in Light of Oral Hygiene and Calculus Formation," Journal of the American Dental Association (January 1958), p. 21.

⁴Harold G. Carter and George P. Barnes, "The Gingival Bleeding Index," Journal of Periodontology (June 1972), p. 803.

⁵M. Massler et al., "Occurrence of Gingivitis in Suburban Chicago School Children," Journal of Periodontology (July 1950), p. 146; Harald Løe, E. Theilade, and S. B. Jensen, "Experimental Gingivitis in Man," Journal of Periodontology (May-June 1965), p. 177; M. Muhlemann and S. Son, "Gingival Sulcus Bleeding" A Leading Symptom in Initial Gingivitis," Helvetica Odontologica Scandinavica (October 1971), p. 107.

⁶M. Muhlemann and S. Son, p. 107; H. G. Carter and G. P. Barnes, p. 803.

The purpose of this investigation was to compare two methods of disease control procedures to determine the main and interaction effects of using the "traditional" method of disease control, the use of disclosing tablets, as an aid to disease control with another approach, the recognition of signs of gingival bleeding, to aid in dental disease control. The investigation was conducted over a 75-day period to determine the effectiveness of each method on the oral health and oral hygiene status of adult dental clients.

All research was conducted at the Old Dominion University Dental Hygiene Clinic in Norfolk, Virginia. Fifty adults between the ages of 18 and 60 were randomly selected from the client records of adults who had attended the Dental Hygiene Clinic for preventive services previously. The adults were randomly assigned to one of two groups. The group used disclosing tablets to reveal areas of dental plaque retention and to aid in the removal of those deposits. The second group recognized signs of gingival bleeding to indicate areas of dental plaque retention and to aid in the removal of those deposits.

All clients attended four appointments. The first appointment included recording the initial oral hygiene status, as measured by the Plaque Index; recording the initial oral health status, as measured by the Gingival Bleeding Index; disease control instructions and an oral prophylaxis. At each subsequent appointment at intervals

of three weeks, one and a half months, and two and a half months, the clients were scored to measure their oral hygiene and oral health status. The study was conducted on a double-blind basis using a randomized subjects pretest-posttest design. A repeated measures analysis of variance was employed to determine the main and interaction effects of the independent variable, method of dental disease control used, on the dependent variables, Plaque Index and Gingival Bleeding Index scores.

Findings from the statistical analysis of baseline data revealed that no significant difference at the 0.05 level existed between the oral health and oral hygiene status of the groups prior to introducing the independent variable. Statistical analysis of subsequent appointments revealed a significant difference at the 0.05 level in the oral health status of subjects in Group A and Group B. The subjects in Group B were significantly more effective in improving their oral health, as measured by the Gingival Bleeding Index, than the subjects in Group A. No statistically significant difference at the 0.05 level existed in the oral hygiene status of Group A and Group B. The Plaque Index scores of both groups improved somewhat from Appointment I through Appointment IV; however, a slightly greater improvement in the Plaque Index scores of Group A was observed, revealing a slight improvement in the oral hygiene status of those subjects using disclosing tablets.

Results of this investigation indicate that there might be an alternative approach to dental disease control to aid in improving the oral health and oral hygiene status of adult dental clients. The results of data analysis revealed a statistically significant difference between the GBI scores for subjects in Group A and in Group B, indicating the method of dental disease control used by Group B was more effective in improving the oral health status of subjects than the "traditional" approach used by the subjects in Group A. Therefore, the use of signs of gingival bleeding as an aid for improving the oral health status of adult dental clients should be considered as a viable approach to dental disease control.

In addition to the effectiveness of the use of gingival bleeding signs as composed with the use of disclosing agents in dental disease control, the ease of educating clients and implementing the former type of disease control program bears equal mention. Educating clients to recognize gingival bleeding as an early indicator of oral health and oral hygiene status can be accomplished with a minimum of materials and manpower. This method also promotes assessment by the dental client at home with a minimum of materials so that a home care regimen for disease control could be easily instituted.

Considering the discussion and limitations of this investigation, for following recommendations for future study are made:

1. Replication of this study utilizing a larger random sample of adult dental clients with a greater variance of age and including adult dental clients who had never attended the Old Dominion University Dental Hygiene Clinic to assure population validity.

2. Replication of this study to include adult dental clients from other practice settings (i.e. private dental offices, public health clinics, etc.) other than those clients who had attended the Old Dominion University Dental Hygiene Clinic.

3. Replication of this study to include a control group receiving no dental disease control education (prophylaxis only).

4. Conduct a longitudinal study to compare the oral health status and oral hygiene performance over a longer period of time to determine if the Plaque Index and Gingival Bleeding Index scores continue to improve.

5. Replication of the study to include reinforcement of the dental disease control procedures at each of the follow-up appointments for oral evaluation to determine if the reinforcement of procedures would aid in improving the oral hygiene status of adult dental clients at a significant level.

6. Conduct an investigation to establish the statistically reliability of the Gingival Bleeding Index.

The results of this research could be considered by dental health professionals in planning and implementing effective methods of dental disease control. Moreover, the results of this research could be used by community health and community dental health professionals when planning and implementing cost effective dental educational programs for large populations.

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APPENDIX A
REASONS FOR SUBJECT ATTRITION

REASONS FOR SUBJECT ATTRITION

| Subject Number | Group Designation | Reason for Subject Attrition |
|----------------|-------------------|---|
| 04 | B | Medical complexities contraindicated treatment |
| 08 | B | Failed to attend initial appointment |
| 20 | B | Extensive periodontal involvement |
| 26 | B | Severe recession and periodontal involvement |
| 33 | A | Severe periodontal involvement |
| 43 | A | Moderate periodontal involvement |
| 45 | A | Unable to attend all scheduled appointments due to employment commitments |
| 47 | A | Failed to attend initial appointment |

APPENDIX B

**CLINICIAN'S DIALOGUE DURING
PROPHYLAXIS PROCEDURES**

CLINICIAN'S DIALOGUE DURING PROPHYLAXIS PROCEDURES

Please REMEMBER: Don't disclose patient.

- Do not give any oral hygiene instructions or patient education to patient.
- Do not mention the amount of plaque accumulation on the teeth.
- Do not mention the absence or presence of gingival inflammation in the patient's mouth.

If the patient should question you about the condition of his/her gingiva or about the plaque accumulation, inform him/her that that aspect of the evaluation will be included in the project.

1. "Good Morning/Afternoon, _____."
2. "I'm _____."
3. "Have you been to our clinic for dental hygiene services before?"
4. If yes, "I'm going to proceed in a similar manner as when you were here before. First, I'll begin with an examination of the lymph glands in your neck. Then I'll examine your mouth which includes an evaluation of your teeth, gums, and other soft tissues in your mouth. I'll be sure to inform you of any significant findings. My instructor will now check the oral examination."

If no, "I'm going to perform an oral examination of your mouth. First, I'll palpate the lymph glands in your neck. Then, I'll begin examining the inside of your mouth; your teeth, your gums, and other soft tissues. I'll be sure to inform you of any significant findings. My instructor will now check the oral examination."

5. The next procedure involves scaling your teeth. This procedure will remove the hard deposits that have accumulated on your teeth."
6. If scaling is not completed by the end of the session, "My instructor will check the teeth that I have finished scaling. You will need to return to have the scaling and polishing completed. The next appointment will take approximately _____ hours."

If scaling is completed, "My instructor will now check the scaling that I have completed."

7. "Now I will polish your teeth. This is very similar to brushing your teeth. Polishing will remove all the soft deposits and stains (caused by smoking, coffee and tea) from your teeth."
8. "The last procedure today will be the fluoride treatment. Fluoride is taken into the teeth to help make them resistant to decay. Please do not eat, drink, or smoke for the next 30 minutes."
9. "Thank you for coming today. Before you leave, Ms. Thompson would like to give you a packet of information about your next 3 appointments."

APPENDIX C

**CLINICAL PROCEDURES FOR STUDENT
CLINICIANS DURING PROPHYLAXIS PRPCEDURES**



department of Dental Hygiene and Dental Assisting • 804-489-6416 • Norfolk, Va 23508

TO: Second Year Dental Hygiene Students
FROM: Ms. Thompson
SUBJECT: Orientation for Student Clinicians
Participating in Research Project

Thank you for participating in this research project. The purpose of this study is to compare two methods of locating and removing dental plaque in adults. One method will involve patients who use disclosing tablets to identify, locate, and remove plaque accumulations. The second method will involve patients observing signs of gingival bleeding to identify areas of plaque accumulation. All procedures that you will render throughout the project will be the same. Every subject will receive a thorough oral examination and a prophylaxis before participating in the study. Please remember not to give your patient any home care instructions or patient education whatsoever during the prophylaxis appointment(s). Please also remember not to disclose your project patient, or mention anything about the gingival condition (color, inflammation, bleeding), or plaque retention.

As you know, deviation from these guidelines could adversely affect the results of this study. It is very important to remain as "neutral" as possible while participating in this project. A rehearsed dialogue has been prepared to aid you in complying with these guidelines.

PLEASE REMEMBER!

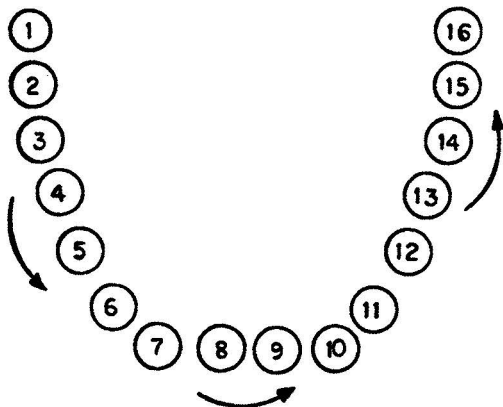
1. Arrive in the clinic approximately 20 minutes prior to start of session.
2. Do wear proper clinic attire.
3. Remain as neutral as possible. Do not use any stimulating verbal or non-verbal communication skills.
4. Remember not to disclose clients, refer to the condition of the gingiva, or mention any plaque accumulation.
5. Do not give any client education to the patient.
6. Perform the prophylaxis procedure as indicated on the following pages.
7. In the event that the client questions you about the condition of his/ her gingiva or his/ her home care, please respond following the rehearsed dialogue.

CLINICAL PROCEDURES

- I. Clinicians will prepare assigned cubicles for rendering an oral prophylaxis on a Class I, Class II or Class III patient.
- II. When patient arrives, the research assistant will bring patient's record folder to your cubicle. Each folder will contain:
 - A. Medical History Form
 - B. Consent Form
 - C. Oral Examination Form
- III. Greet patient in reception area and escort to cubicle. Seat patient and begin clinical procedures. You should plan to start working by 9:10 or 1:10.
 - A. Review medical history--the medical history should have already been completed. It should already have been screened for medical complexities that contraindicate treatment. You should, however, update the information and bring any additional significant findings to the attention of the project director or the research assistant. After updating the medical history, have the patient sign and date it and place it in the patient's folder.
 - B. Perform Modified Oral Examination (with mouth mirror, Hu-Freidy Number 5 explorer and Hu-Freidy Number 12 periodontal probe).
 1. Perform extraoral examination--Palpate submandibular, submental lymph glands and lymph node chain bilaterally on neck.
 2. Intraoral examination--Proceed with examination as listed on oral exam form for soft tissues. Record only significant findings. List only significant pocket depths 6 mm or greater. Pathologic findings are to be indicated on ALERT BOX.
 3. Charting--chart missing teeth, caries, and defective restorations only. Existing satisfactory restorations do not need to be recorded.
 4. Determine occlusion and extremely malpositioned teeth. Identify teeth that may be involved in traumatic occlusion.
 5. Fill in treatment plan. Turn on your green cubicle light.

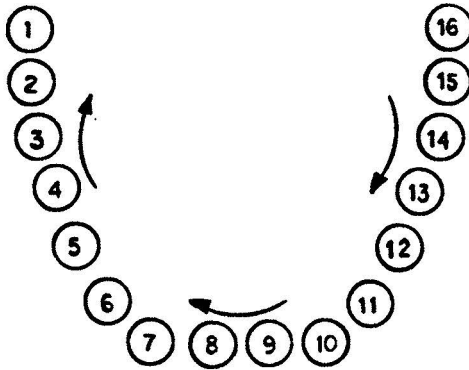
6. Instructor will silently review your oral examination findings and review your treatment plan.
 7. After receiving approval of treatment plan, you may proceed with your treatment. Hopefully, you should begin your treatment at 10:00-10:15 or 1:00-1:15. If radiographs are indicated, take these before beginning treatment.
- C. Begin scaling procedures.
1. Complete all scaling before having instructor check.
 2. If scaling is unable to be completed, have instructor check quadrants completed.
 3. If no quadrants are completed, have instructor check your patient for a dismissal check.
- D. Perform prophylaxis procedures (without disclosing).
1. With proper armamentarium begin the prophylaxis procedure.
 2. Begin prophylaxis starting with the facial surface of the posterior-most tooth in the maxillary right quadrant.
 3. Follow this diagram for the prophylaxis procedure:

Polish
Facial
Surfaces



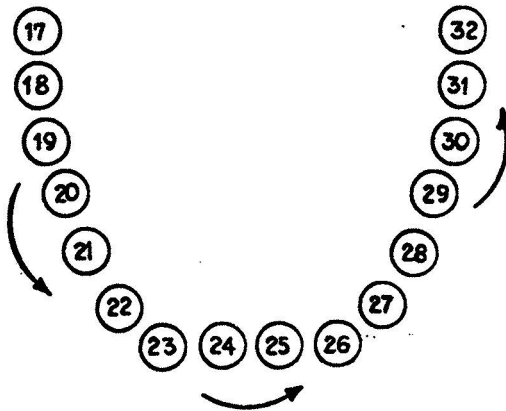
4.

Polish
Lingual
Surfaces



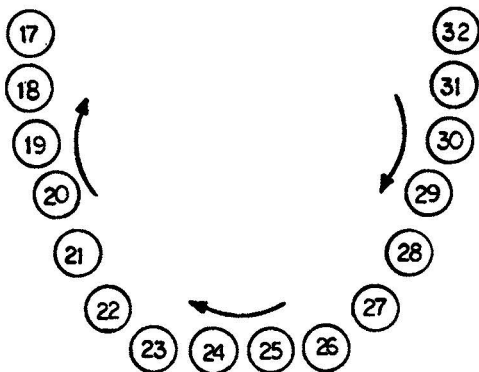
5. Proceed to mandibular arch:

Polish
Facial
Surfaces



6.

Polish
Lingual
Surfaces



7. Polish all occlusal surfaces with prophylaxis brush. Start with tooth #1 and proceed to tooth #16, #17 through #32.
8. Floss patient's teeth beginning with distal of posterior-most tooth in maxillary right quadrant. Proceed in same manner as in #7 above.
9. Have instructor check polishing. Remember not to disclose patient.
10. Apply $F1_2$ if patient requests it or you feel it is indicated.
11. Give completed patient blue letter in folder and call project director to cubicle.
12. Escort patient to door.

APPENDIX D
PLAQUE INDEX SCORING CHART

PLAQUE INDEX SCORING CHART

Subject No.: _____

Appt. #: _____

Date: _____

Criteria for P.I. System

- 0 = No plaque in the gingival area.
- 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may only be recognized by running a probe along the tooth surface.
- 2 = Moderate accumulation of soft deposits within the gingival crevice, on the gingival margin and/or adjacent tooth surface, which can be seen by the unaided eye.
- 3 = Abundance of soft matter within the gingival crevice and/or on the gingival margin and adjacent tooth surface.

| Tooth Number | 3 | 6 | 8 | 9 | 11 | 14 | 19 | 22 | 24 | 25 | 27 | 30 |
|---------------|---|---|---|---|----|----|----|----|----|----|----|----|
| Distal | | | | | | | | | | | | |
| Facial | | | | | | | | | | | | |
| Mesial | | | | | | | | | | | | |
| Lingual | | | | | | | | | | | | |
| Mean GI/Tooth | | | | | | | | | | | | |

Mean P.I. Score

APPENDIX E

GINGIVAL BLEEDING INDEX SCORING CHART

GINGIVAL BLEEDING INDEX SCORING CHART

Subject No.: _____

Appt. #: _____

Date: _____

Code

B = Bleeding

O = Not bleeding

X = Not scoreable

| | | | | | | | | | | | | | |
|--------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Interproximal Area | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Interproximal Area | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 |
| | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |

Total scoreable areas _____

Total bleeding areas _____

Total nonbleeding areas _____

APPENDIX F

**DENTAL DISEASE CONTROL INSTRUCTIONS--
REHEARSED DIALOGUE**

DENTAL DISEASE CONTROL INSTRUCTIONS
Group A
(Using Disclosing Tablets)

Principal Investigator: "Welcome to the O.D.U. Dental Hygiene Clinic. Thank you for being a participant in this study. The subject of this educational session is the prevention and control of dental disease. As most of you know, plaque is the cause of dental disease. You have learned from your previous visits to the dental hygiene clinic that dental plaque is a sticky film of bacteria that adheres to the teeth and around the gums, causing tooth decay and periodontal or gum disease. I would like you to view a film now about dental disease and the proper methods for cleansing your mouth to control dental disease."

(Subjects were then instructed to move to assigned classroom for viewing film.)

Principal Investigator: "Are there any questions about the film? Remember you will be using disclosing tablets as demonstrated in the film to reveal the areas of plaque retention to aid you in properly cleansing your mouth. The research assistants will provide you with an envelope of aids to use at home for cleansing your mouth. There is a sheet of instructions provided in the envelope for the procedure to use for cleansing your mouth. Please check your envelope to be sure you have a soft bristle toothbrush, a dispenser of dental floss, disclosing tablets, a mouth mirror and a sheet of home care procedures to follow. Thank you for your attention today."

(Subjects then were taken to the Dental Hygiene Clinic for a review of their health history, an oral examination for determining eligibility for participation in the study and an oral prophylaxis.)

DENTAL DISEASE CONTROL INSTRUCTIONS
Group B
(Recognizing Signs of Gingival Bleeding)

Principal Investigator: "Welcome to the O.D.U. Dental Hygiene Clinic. Thank you for being a participant in this study. The subject of this educational session is the prevention and control of dental disease. As most of you know, plaque is the cause of dental disease. You have learned from your previous visit to the dental hygiene clinic that dental plaque is a sticky film of bacteria that adheres to the teeth and around the gums, causing tooth decay and periodontal disease. I would like you to view a film now about dental disease and the proper methods for cleansing your mouth to control dental disease."

(Subjects were then instructed to move to assigned classroom for viewing film.)

Principal Investigator: "Are there any questions about the film? Remember you will be looking for signs of bleeding gingiva (gums) as demonstrated in the film to indicate the areas of plaque retention to aid you in properly cleansing your mouth. The research assistants will provide you with an envelope of aids to use at home for cleansing your mouth. There is a sheet of instructions provided in the envelope for the procedure to use for cleansing your mouth. Please check your envelope to be sure you have a soft bristle toothbrush, a dispenser of dental floss, a mouth mirror and a sheet of home care procedures to follow. Thank you for your attention today."

(Subjects then were taken to the Dental Hygiene Clinic for a review of their health history, an oral examination for determining eligibility for participation in the study and an oral prophylaxis.)

APPENDIX G

**LETTER TO SUBJECTS DISCUSSING PROCEDURES
FOR SUBSEQUENT APPOINTMENTS
I THROUGH IV**



School of Sciences and Health Professions
Department of Dental Hygiene and Dental Assisting • (804) 440-4310 • Norfolk, VA 23508

Dear Project Participant:

You have now completed the initial phase of the project. The most important part of the project will follow. The treatment rendered here at the O.D.U. Dental Hygiene Clinic will enable you to have clean teeth only temporarily. The procedures demonstrated in the educational session, if practiced regularly, will enable you to maintain good oral health. Your next appointment is scheduled in three weeks. The date of that appointment is Saturday, February 16th. Your scheduled appointment time is indicated at the top of this letter. It is of the utmost importance that you keep your scheduled appointment and arrive at the Dental Hygiene Clinic promptly. If a problem arises and you have difficulty keeping your appointment, please call 627-7778. Failure to keep scheduled appointments could jeopardize the validity of the success of the project.

At your next appointment a registered dental hygienist will perform an oral examination that will involve probing around your mouth to examine your teeth and gums. The second follow-up appointment will be scheduled for one and a half months after the first visit. This appointment will be very brief (approximately fifteen minutes). An oral examination similar to the one conducted in the first appointment will be performed. The last appointment will be similar to the second appointment and will be scheduled two and a half months after the initial visit.

Thank you for your cooperation and continued participation in this project! I look forward to seeing you in two weeks.

Sincerely,

Susan E. Thompson, R.D.H., B.S.
Graduate Student

APPENDIX H
FOLLOW-UP LETTER TO SUBJECTS



School of Sciences and Health Professions
Department of Dental Hygiene and Dental Assisting • (804) 440-4310 • Norfolk, VA 23508

April 1980

Dear Participant:

Today's visit at the Dental Hygiene Clinic will be the last appointment for the research project. The purpose of the project was to compare two methods of improving oral health and oral hygiene in adults. The results of the study will be available in July 1980. At that time, I will forward the results to you.

It was a pleasure working with you. Without your cooperation, the project would not have been possible. I appreciate your interest in dental health and the future dental health of others. I hope that you will continue to use the preventive oral health services available at the Dental Hygiene Clinic on a regular basis.

Sincerely,

Susan E. Thompson, R.D.H., B.S.
Graduate Student

APPENDIX I
HOME CARE INSTRUCTIONS

DAILY HOME CARE INSTRUCTIONS ~~FOR GROUP A~~

Remember to clean your teeth at least once daily. A recommended home care program includes:

1. brushing once in the morning and again prior to retiring; and
2. flossing the teeth once daily before retiring. The flossing procedure should take place immediately prior to the evening brushing.

Use the toothbrush and dental floss provided. The following points are a brief summary of what you observed in the film.

Toothbrushing

1. Upper teeth--start brushing the right side of the outer surfaces of the teeth and proceed to the left. Then beginning on the left side, brush the inner surfaces of the teeth. Brush the chewing surfaces of the back teeth using a circular motion. Pay careful attention to place the toothbrush bristles against the tooth so that the areas of gum around the teeth are properly cleaned.
2. Lower teeth--next move to the lower arch and proceed using the same techniques as described in Step 1. Pay careful attention to clean the gums around the teeth.
3. After brushing all tooth surfaces, examine your mouth for areas of remaining plaque. The stained areas indicate that you may not be effectively cleaning these areas. If areas of plaque still remain, repeat the procedure to insure proper cleaning.

Dental Flossing

1. Start by using an 18" length of dental floss, wrapping the floss around your index finger. Begin flossing by carefully guiding the floss between the teeth as shown in the film.
2. Once again, start in the upper right area and move to the left. When the upper arch has been completely flossed, move to the lower arch and repeat the flossing procedure as for the upper arch.
3. Examine the areas between the teeth for areas of remaining plaque. Repeat the procedure in these areas.

REMEMBER AREAS OF PLAQUE RETENTION ARE INDICATIONS OF AREAS THAT NEED TO BE CLEANED MORE THOROUGHLY!

DAILY HOME CARE INSTRUCTIONS FOR GROUP B

Remember to clean your teeth at least once daily. A recommended home care program includes:

1. brushing once in the morning and again prior to retiring; and
2. flossing the teeth once daily before retiring. The flossing procedure should take place immediately prior to the evening brushing.

Use the toothbrush and dental floss provided. The following points are a brief summary of what you observed in the film.

Toothbrushing

1. Upper teeth--start brushing the right side of the outer surfaces of the teeth and proceed to the left. Then beginning on the left side, brush the inner surfaces of the teeth. Brush the chewing surfaces of the back teeth using a circular motion. Pay careful attention to place the toothbrush bristles against the tooth so that the areas of gum around the teeth are properly cleaned.
2. Lower teeth--next move to the lower arch and proceed using the same techniques as described in Step 1. Pay careful attention to clean the gums around the teeth.
3. After brushing all tooth surfaces, examine your mouth for areas of remaining plaque. The stained areas indicate that you may not be effectively cleaning these areas. If areas of plaque still remain, repeat the procedure to insure proper cleaning.

Dental Flossing

1. Start by using an 18" length of dental floss, wrapping the floss around your index finger. Begin flossing by carefully guiding the floss between the teeth as shown in the film.
2. Once again, start in the upper right area and move to the left. When the upper arch has been completely flossed, move to the lower arch and repeat the flossing procedure as for the upper arch.
3. Examine the areas between the teeth for areas of remaining plaque. Repeat the procedure in these areas.

REMEMBER AREAS OF PLAQUE RETENTION ARE INDICATIONS OF AREAS THAT NEED TO BE CLEANED MORE THOROUGHLY!

APPENDIX J

**CONSENT FORM FOR PREVENTIVE
AND THERAPEUTIC SERVICES**



department of Dental Hygiene and Dental Assisting • 804-489-6416 • Norfolk, Va. 23508

OLD DOMINION UNIVERSITY DENTAL HYGIENE CLINIC
CONSENT FORM

I consent to participate in the project being conducted at the O.D.U. Dental Hygiene Clinic. The information requested is, to the best of my knowledge, correct. I hereby consent to have therapeutic and preventive services performed during the initial appointments and the three subsequent appointments at Old Dominion University Dental Hygiene Clinic.

(Signature)

(Date)

PLEASE NOTE: If it is necessary for you to visit your dentist during this project, please inform him of your participation in this project. Please ask that he not render a prophylaxis (cleaning) procedure or give you any oral hygiene instructions. Please use only the supplies given and procedures demonstrated to identify and remove the plaque from your teeth during the conduct of this study.

APPENDIX K

COVER LETTER, MEDICAL HISTORY AND
INITIAL CONSENT FORM



School of Science and Health Professions
 Department of Dental Hygiene and Dental Assisting • (804) 440-4310 • Norfolk, VA 23508

January 1980

Dear Patient:

Our records indicate that you have attended the O.D.U. Dental Hygiene Clinic. We look forward to seeing you again. We are conducting a project to test the effectiveness of two methods of locating, identifying, and removing dental plaque (a bacterial film that adheres to teeth and collects around gums causing dental decay and gum disease). Because of your interest in improving your dental health, a unique opportunity exists for you to become a participant in the study. The result of this project may mean better dental health for you and for others.

Participation in the project will necessitate your attendance at several appointments at the O.D.U. Dental Hygiene Clinic. The initial visit will involve a thorough examination of your mouth and a patient education session. This appointment will be scheduled on _____ at _____. A student dental hygienist will thoroughly clean your teeth at the next appointment. This appointment will be scheduled on _____ or _____. Please indicate in the space provided the time most convenient for you. If these scheduled times are inconvenient for you, please indicate in the space provided a time that would be convenient for you. Please be sure to include on the medical history form the correct phone numbers where you can be contacted to confirm your appointment times. After the initial visits, you will be required to return for three subsequent visits:

Follow-up Appointment #1--(three week follow-up). An oral examination will be completed at this visit. The appointment will take approximately 15 minutes. This visit will be scheduled on a Saturday or a time most convenient for you.

Appointment #2--(one and a half month follow-up). This appointment will be similar to appointment #1. Once again, it will be scheduled at a time most convenient for you.

Appointment #3--(two and a half month follow-up). This appointment will be similar to the first two appointments. This will be the final appointment for the project.

During this project, all dental hygiene services will be rendered free of charge. A toothbrush, unweaved dental floss and other oral hygiene aids will be provided free of charge also.

If you would like to be considered for participation in this project please complete the required medical history and the preliminary consent form. Enclosed is a self-addressed, stamped envelope for your convenience in returning the forms to the O.D.U. Dental Hygiene Clinic. Please complete the forms and return by _____. Your eligibility to participate in the study will be determined from the information provided. I look forward to working with you in this project!

Sincerely,

Susan E. Thompson, R.D.H.
 Graduate Student

**INITIAL CONSENT TO PARTICIPATE FORM
O.D.U. DENTAL HYGIENE CLINIC**

I understand I may be selected as a member of a group participating in a project, the purpose of which is to investigate two methods of removing dental plaque from teeth.

I understand that the procedure will involve approximately one or two initial visits and three subsequent appointments. The initial appointment(s) will be held during the week and will last approximately three hours. The initial appointment(s) will be spent having an oral prophylaxis (your teeth cleaned) and learning about your oral health. After the prophylaxis appointment, I will return to the O.D.U. Dental Hygiene Clinic for three fifteen minute appointments that will be scheduled at intervals of three weeks, one and a half months and two and a half months respectively.

I have completed a medical history and verify that all the questions have been answered truthfully and to the best of my knowledge.

I understand that I may withdraw my participation in the project at any time without compromising my eligibility for future dental hygiene services at the O.D.U. Dental Hygiene Clinic.

I understand that my participation in the study may be terminated by the project director at any time.

I understand that the results of this study may be published or presented orally, but I will in no way be identified individually.

I understand that all services rendered during participation in the project will be free of charge including the cleaning and fluoride procedures.

I understand that participation in this study is strictly voluntary and that no monetary compensation will be given.

I understand that the information sought may result in better dental care in the future.

I have read and understand all the above information. I consent to participate in the project being conducted at the O.D.U. Dental Hygiene Clinic.

(Signature)

(Witness)

(Date)

Subject Number _____

HEALTH HISTORY

Dental Hygiene Clinic
OLD DOMINION UNIVERSITY

For safe, personalized dental hygiene care, a complete and accurate health history is necessary. Dental procedures may complicate or be complicated by existing conditions elsewhere in the body; general health factors influence response to treatment. Please give each question below careful consideration and answer to the best of your knowledge.

Name: _____ Birthdate _____ Sex: M F
(last) (first) (MI)

Address: _____ Home Phone: _____
(street) (city) (zip)

Occupation: _____ Work Phone: _____

Physician's Name: _____ Phone: _____

Location: _____
(city) (state)

Dentist's Name: _____ Phone: _____

Location: _____
(city) (state)

In case of emergency, notify: _____ Phone: _____

DENTAL HEALTH:

Reason for this visit: _____

When was your last dental appointment? _____ Treatment received _____

Were x-rays taken? _____ How often do you visit the dentist? _____

How would you rate the dentistry performed in your mouth in the past? Good Fair Poor

Have you had any problems associated with past dental care? _____

How would you rate your present oral health? Good Fair Poor _____

How do you clean your mouth? _____

Have you ever used disclosing tablets or solution? _____

MEDICAL HEALTH:

How would you rate your present health? Good Fair Poor _____

Has there been a change in your health in the past year? _____ If yes, please explain _____

Have you ever had a serious illness or an operation? _____ If yes, please explain: _____

Have you been hospitalized in the past five years? _____ If yes, please explain: _____

When was your last physical examination? _____

Lab tests and other tests: _____

Results: _____

Are you currently under a physician's care? _____ If yes, please explain: _____

Are you currently taking any medication? (including aspirin, vitamins, birth control pills) Yes No Medicine Daily Dosage Condition for Which Taken

| Yes | No | Medicine | Daily Dosage | Condition for Which Taken |
|-------|-------|----------|--------------|---------------------------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

Have you ever been treated for or been told by a doctor you have or had any of the following:

- | | | |
|---|-----|----|
| 1. Allergies (ex.: hay fever, medications, foods)..... | Yes | No |
| 2. Unusual reaction to Novacaine or other medication..... | Yes | No |
| 3. Respiratory disorders (ex.: asthma, bronchitis)..... | Yes | No |
| 4. Congenital heart disease (ex.: heart murmur)..... | Yes | No |
| 5. Rheumatic fever..... | Yes | No |
| 6. Cardiac surgery..... | Yes | No |
| 7. Coronary artery disease (ex.: angina, heart attack)..... | Yes | No |
| 8. Cerebrovascular accident (ex.: stroke, arterial spasms)..... | Yes | No |
| 9. Hypotension (low blood pressure)..... | Yes | No |
| Hypertension (high blood pressure)..... | Yes | No |
| 10. Nervous system disorders (ex.: seizures, epilepsy, cerebral palsy)..... | Yes | No |
| 11. Blood disorder (ex.: anemia, leukemia, free bleeder)..... | Yes | No |
| 12. Diabetes..... | Yes | No |
| 13. Hepatitis (ex.: jaundice, liver disease)..... | Yes | No |
| 14. Venereal disease (ex.: syphilis, gonorrhoea, herpes)..... | Yes | No |
| 15. Tuberculosis or positive TB test..... | Yes | No |
| 16. Kidney disease..... | Yes | No |
| 17. Arthritis, rheumatism..... | Yes | No |
| 18. Cancer..... | Yes | No |
| 19. Women: Are you pregnant? Trimester:_____ | Yes | No |

Please explain all yes answers: _____

Have you experienced any of the following?

- | | | |
|---|-----|----|
| Pain, pressure, tightness in the chest upon exertion..... | Yes | No |
| Shortness of breath..... | Yes | No |
| Swelling of ankles..... | Yes | No |
| Persistent cough..... | Yes | No |
| Bruise easily..... | Yes | No |
| Prolonged bleeding..... | Yes | No |
| Frequent headaches..... | Yes | No |
| Dizziness, fainting..... | Yes | No |
| Frequent urination (more than 6 times/day)..... | Yes | No |
| Frequent thirst..... | Yes | No |
| Frequent dry mouth..... | Yes | No |
| Weight gain or loss of more than 10 lbs..... | Yes | No |
| Slow healing..... | Yes | No |

Have you ever had radiation therapy for treatment of any oral or physical condition? If yes, please explain _____

Have you ever had a blood transfusion? _____

Is there any additional information about your health that has not been covered above? _____

Date R.P. Student Signature Patient Signature Instructor

FOR OFFICE USE ONLY.

PDR INFORMATION

APPENDIX L
RAW PLAQUE INDEX SCORES FOR GROUP A

RAW PLAQUE INDEX SCORES FOR GROUP A

| Subject Number | Appt. I (Pretest) | Appt. II (3 wks) | Appt. III (1.5 mos) | Appt. IV (2.5 mos) |
|----------------|-------------------|------------------|---------------------|--------------------|
| 01 | 0.6667 | 0.2917 | 0.3958 | 0.4167 |
| 03 | 0.6250 | 0.3333 | 0.5000 | 0.6667 |
| 05 | 0.4375 | 0.3542 | 0.1875 | 0.4167 |
| 07 | 0.5833 | 0.5000 | 0.4583 | 0.2708 |
| 09 | 0.6042 | 0.3958 | 0.4853 | 0.2292 |
| 11 | 1.2083 | 0.7708 | 0.2500 | 0.6042 |
| 13 | 0.3125 | 0.8750 | 0.1667 | 0.2708 |
| 15 | 0.5208 | 0.3542 | 0.3750 | 0.0833 |
| 17 | 0.4167 | 0.3750 | 0.2500 | 0.5417 |
| 19 | 0.7500 | 0.5208 | 0.5000 | 0.4792 |
| 21 | 0.4792 | 0.3542 | 0.2917 | 0.3333 |
| 23 | 0.5625 | 0.4792 | 0.3958 | 0.3750 |
| 25 | 0.8333 | 0.2500 | 0.2292 | 0.2292 |
| 27 | 0.6458 | 0.4167 | 0.3958 | 0.3750 |
| 29 | 0.4583 | 0.1458 | 0.1667 | 0.2917 |
| 31 | 0.1667 | 0.4375 | 0.1042 | 0.2917 |
| 33 | ----- | ----- | ----- | ----- |
| 35 | 0.2500 | 0.1875 | 0.0000 | 0.0833 |
| 37 | 0.8542 | 0.6875 | 0.6667 | 0.6458 |
| 39 | 0.1042 | 0.5000 | 0.0417 | 0.1667 |
| 41 | 0.6875 | 0.2917 | 0.2500 | 0.2292 |
| 43 | ----- | ----- | ----- | ----- |
| 45 | ----- | ----- | ----- | ----- |
| 47 | ----- | ----- | ----- | ----- |
| 49 | 0.7917 | 0.3750 | 0.3333 | 0.6458 |

APPENDIX M
RAW PLAQUE INDEX SCORES FOR GROUP B

RAW PLAQUE INDEX SCORES FOR GROUP B

| Subject Number | Appt. I (Pretest) | Appt. II (3 wks) | Appt. III (1.5 mos) | Appt. IV (2.5 mos) |
|----------------|----------------------|---------------------|------------------------|-----------------------|
| 02 | 0.4375 | 0.8750 | 0.3958 | 0.0833 |
| 04 | ----- | ----- | ----- | ----- |
| 06 | 0.7292 | 0.5417 | 0.5208 | 0.2917 |
| 08 | ----- | ----- | ----- | ----- |
| 10 | 0.8333 | 0.4583 | 0.4792 | 0.3958 |
| 12 | 0.5000 | 0.1875 | 0.1667 | 0.5000 |
| 14 | 0.5833 | 0.3542 | 0.4375 | 0.2083 |
| 16 | 0.7083 | 0.2917 | 0.2500 | 0.6875 |
| 18 | 0.3750 | 0.1875 | 0.0313 | 0.2708 |
| 20 | ----- | ----- | ----- | ----- |
| 22 | 0.6250 | 0.4792 | 0.3750 | 0.2083 |
| 24 | 0.5417 | 0.3150 | 0.5625 | 0.0833 |
| 26 | ----- | ----- | ----- | ----- |
| 28 | 0.6271 | 0.4167 | 0.2708 | 0.2292 |
| 30 | 0.4375 | 0.2292 | 0.1875 | 0.1667 |
| 32 | 0.4792 | 0.4167 | 0.3542 | 0.2292 |
| 34 | 0.0833 | 0.1458 | 0.9375 | 0.1667 |
| 36 | 0.6042 | 0.5417 | 0.7500 | 0.2500 |
| 38 | 0.6458 | 0.5417 | 0.1875 | 0.5208 |
| 40 | 0.6250 | 0.4792 | 1.1042 | 0.4583 |
| 42 | 0.0833 | 0.5417 | 0.2708 | 0.2292 |
| 44 | 0.0208 | 0.2291 | 0.1667 | 0.0417 |
| 46 | 0.1875 | 0.8334 | 0.3750 | 0.5417 |
| 48 | 1.3563 | 1.6670 | 0.9583 | 0.9167 |
| 50 | 0.3958 | 0.2917 | 0.2500 | 0.2292 |

APPENDIX N
RAW GINGIVAL BLEEDING INDEX SCORES
FOR GROUP A

RAW GINGIVAL BLEEDING INDEX SCORES FOR GROUP A

| Subject Number | Appt. I (Pretest) | Appt. II (3 wks) | Appt. III (1.5 mos) | Appt. IV (2.5 mos) |
|----------------|-------------------|------------------|---------------------|--------------------|
| 01 | 0.0869 | 0.0416 | 0.0000 | 0.0000 |
| 03 | 0.0384 | 0.0384 | 0.0384 | 0.0000 |
| 05 | 0.1666 | 0.0000 | 0.0000 | 0.0416 |
| 07 | 0.2692 | 0.1153 | 0.1538 | 0.0769 |
| 09 | 0.1250 | 0.0434 | 0.0000 | 0.0000 |
| 11 | 0.1923 | 0.1153 | 0.0000 | 0.5769 |
| 13 | 0.4230 | 0.3076 | 0.5384 | 0.3846 |
| 15 | 0.1923 | 0.0000 | 0.0000 | 0.1538 |
| 17 | 0.1250 | 0.0416 | 0.0000 | 0.0000 |
| 19 | 0.0769 | 0.0384 | 0.1538 | 0.1923 |
| 21 | 0.0800 | 0.4000 | 0.3600 | 0.3200 |
| 23 | 0.1538 | 0.0769 | 0.0769 | 0.1153 |
| 25 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 27 | 0.0000 | 0.0000 | 0.0000 | 0.0384 |
| 29 | 0.2916 | 0.0833 | 0.2916 | 0.0434 |
| 31 | 0.3076 | 0.4230 | 0.1153 | 0.0384 |
| 33 | ----- | ----- | ----- | ----- |
| 35 | 0.0000 | 0.0000 | 0.0416 | 0.0833 |
| 37 | 0.4583 | 0.2916 | 0.2500 | 0.2500 |
| 39 | 0.2307 | 0.0000 | 0.3461 | 0.2307 |
| 41 | 0.3461 | 0.1153 | 0.0769 | 0.1153 |
| 43 | ----- | ----- | ----- | ----- |
| 45 | ----- | ----- | ----- | ----- |
| 47 | ----- | ----- | ----- | ----- |
| 49 | 0.1923 | 0.0000 | 0.0000 | 0.0000 |

APPENDIX O
RAW GINGIVAL BLEEDING INDEX SCORES
FOR GROUP B

RAW GINGIVAL BLEEDING INDEX SCORES FOR GROUP B

| Subject Number | Appt. I (Pretest) | Appt. II (3 wks) | Appt. III (1.5 mos) | Appt. IV (2.5 mos) |
|----------------|----------------------|---------------------|------------------------|-----------------------|
| 02 | 0.0000 | 0.0384 | 0.0384 | 0.0000 |
| 04 | ----- | ----- | ----- | ----- |
| 06 | 0.6538 | 0.0769 | 0.0384 | 0.0769 |
| 08 | ----- | ----- | ----- | ----- |
| 10 | 0.3076 | 0.1538 | 0.0769 | 0.0000 |
| 12 | 0.1666 | 0.0416 | 0.0000 | 0.0952 |
| 14 | 0.1153 | 0.0000 | 0.1153 | 0.0769 |
| 16 | 0.2692 | 0.1153 | 0.0384 | 0.0000 |
| 18 | 0.2307 | 0.0769 | 0.0384 | 0.0384 |
| 20 | ----- | ----- | ----- | ----- |
| 22 | 0.1923 | 0.0769 | 0.1153 | 0.2307 |
| 24 | 0.3846 | 0.0000 | 0.0000 | 0.0000 |
| 26 | ----- | ----- | ----- | ----- |
| 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | 0.0400 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 0.2941 | 0.0000 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0434 | 0.0000 | 0.0000 |
| 36 | 0.1153 | 0.0384 | 0.0769 | 0.0769 |
| 38 | 0.2380 | 0.0454 | 0.0000 | 0.0952 |
| 40 | 0.1153 | 0.0000 | 0.0384 | 0.0000 |
| 42 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 0.1153 | 0.0769 | 0.0384 | 0.0000 |
| 46 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | 0.3076 | 0.1153 | 0.1923 | 0.1923 |
| 50 | 0.1538 | 0.0000 | 0.0000 | 0.0000 |

APPENDIX P
CHARACTERISTICS OF SAMPLE GROUPS
IN THE POPULATION

CHARACTERISTICS OF SAMPLE GROUPS IN THE POPULATION (N = 42)

Total Sample Population

| |
|-----------------|
| N = 42 |
| Males = 16 |
| Females = 26 |
| Mean age = 33.9 |
| s.d. = 11.40 |

Group A
(Using Disclosing Yablets)

| |
|-----------------|
| n = 21 |
| Males = 7 |
| Females = 14 |
| Mean age = 33.9 |
| s.d. = 10.40 |

Group B
(Recognizing Gingival Bleeding)

| |
|-----------------|
| n = 21 |
| Males = 9 |
| Females = 12 |
| Mean age = 32.6 |
| s.d. = 12.62 |

APPENDIX Q

DATA FOR ESTABLISHING INTRARATER RELIABILITY

INTRARATER RELIABILITY TEST DATA

| Subject | 1st PI Scoring (X) | 2nd PI Scoring (Y) | X ² | Y ² | XY |
|---------|--------------------------|--------------------------|----------------|----------------|-----------|
| A | 0.4375 | 0.4375 | 0.1914063 | 0.1914063 | 0.0366364 |
| B | 0.0833 | 0.0833 | 0.0069388 | 0.0069388 | 0.0000481 |
| C | 0.1875 | 0.1875 | 0.0351562 | 0.0351562 | 0.0012360 |
| D | 0.3542 | 0.3542 | 0.1254576 | 0.1254576 | 0.0157396 |
| E | 0.2708 | 0.2708 | 0.0733260 | 0.0733260 | 0.0053767 |
| F | 0.5417 | 0.5417 | 0.2934388 | 0.2934388 | 0.0861063 |
| G | 0.1875 | 0.1667 | 0.4726562 | 0.0277888 | 0.0009769 |
| H | 0.6875 | 0.6667 | 0.4726562 | 0.4444888 | 0.2100904 |
| I | 0.2500 | 0.2500 | 0.0625000 | 0.0625000 | 0.0039063 |
| J | 0.5000 | 0.5000 | 0.2500000 | 0.2500000 | 0.0625000 |
| K | 0.3750 | 0.3750 | 0.1406250 | 0.1406250 | 0.0197754 |
| L | 0.1458 | 0.1667 | 0.0212576 | 0.0277888 | 0.0005907 |
| M | 0.2917 | 0.2917 | 0.0850889 | 0.0850889 | 0.0072401 |
| N | 0.4167 | 0.4167 | 0.1736388 | 0.1736388 | 0.0301504 |
| O | 0.1042 | 0.1042 | 0.0108576 | 0.0108576 | 0.0001179 |
| P | 0.8333 | 0.8333 | 0.6943888 | 0.6943888 | 0.4821758 |
| Q | 0.2500 | 0.2500 | 0.0625000 | 0.0625000 | 0.0039063 |
| R | 0.3750 | 0.3750 | 0.1406250 | 0.1406250 | 0.0197754 |
| S | 0.2500 | 0.2500 | 0.0625000 | 0.0625000 | 0.0039063 |
| T | 0.6458 | 0.6458 | 0.4170576 | 0.4170576 | 0.1739371 |

r = +0.84