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Effects of Tooth Whitening Use on Oral Health Interests and Values in Adults

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EFFECTS OF TOOTH WHITENING USE ON ORAL HEALTH INTERESTS AND VALUES IN ADULTS

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ABSTRACT

Effects of Tooth Whitening on Oral Health Interests and Values in Adults

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The primary purpose of this study was to determine if tooth whitening product use influences oral health interests and values in an adult population. A two-group, randomized, pre-test, multiple post-test design was used for studying 60 adults between the ages of 18 and 60. Persons who use tobacco products, have composite/tooth-colored anterior restorations, less than eight anterior teeth, pregnant or lactating women, or those who have previously used a whitening product other than toothpaste were excluded from the study. At baseline, a researcher-designed *Oral Health Questionnaire* was administered to consenting adults to determine the level of oral health interests and values. A three-week, twice daily whitening strip regimen was administered to 30 randomized participants; the remaining 30 participants received no whitening treatment for the same three-week period. All individuals were instructed to use the same toothpaste, toothbrush and floss, and brush twice daily for two minutes at each brushing session. The questionnaire was re-administered at two and four-weeks after baseline to determine change in individuals' oral health interests and values. Useable data were collected from 50 adults, 22 adults who received whitening treatment and 28 adults who received no treatment. The Wald-Chi Squared test at $p=.05$ was used to determine relationships between tooth color and various oral health interests and values. Results showed that both the whitening and non-whitening groups experienced a significant

increase in their oral health interests from baseline to four weeks. Those in the experimental group who found their teeth lighter in shade had more interest in their overall oral health than those whose tooth shade did not change. An increase in participants' oral health interest and value occurred; however, both the experimental and control groups' interests and values increased at the same rate. Only the experimental group had a significant change in their oral health values after improvement in their tooth color. As tooth color lightened, oral health values increased. Results also revealed a link between whiter teeth and an increase in the value and interest one might place on their oral health. More research is needed before vital tooth whitening can be viewed as a therapeutic procedure.

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CHAPTER I

INTRODUCTION

Tooth whitening procedures and whitening products have earned enthusiastic consumer interest and financial investment since the late 1990's. With more accessible, cost-conscious, over-the-counter and professionally-dispensed whitening products available, the general population is choosing vital tooth whitening as a desirable cosmetic oral procedure. Although many people use both self-administered and professionally-administered bleaching regimens, it is not known if tooth whitening can influence a person's oral health interests and values or their oral healthcare seeking behaviors. Christensen (2006) believes that proper bleaching can be a highly positive behavior-changing procedure whose effect can encourage patients to maintain their new smile. Little research has been conducted regarding the relationship between whiter teeth and levels of commitment to personal oral health. Using a questionnaire, this present study acquired information about adults' oral health interests and values, and then treated half the participants with a self-administered three-week whitening regimen. The participants were evaluated again with the same questionnaire at two and four-weeks after baseline to determine changes in oral health interests and values that might be related to their tooth whitening experience.

Statement of the Problem

This study determined if use of a tooth whitening regimen influenced adults' oral health values and interest in their own oral health over a short period of time. The specific research questions were:

- Do adults change their oral health values after using a 21-day vital tooth-whitening product?

- Do adults change their oral health interests after using a 21-day vital tooth-whitening product?
- Are adults more interested in maintaining good oral hygiene habits and in keeping their teeth in good health after using a 21-day vital tooth whitening product?
- Is there a relationship between the level of tooth whitening achieved and the inclination of the oral health values?

Significance of the Problem

The popularity of vital tooth whitening and availability of whitening products in dental offices and over-the-counter have steadily increased within the past 20 years. Research in tooth bleaching and tooth stain removal has also steadily increased (Sarrett, 2002). Although these whitening procedures have attracted the attention of consumers, it is not known whether tooth whitening influences interest in and value of ones' oral hygiene and oral health status. In a survey by Freedman (1995), 50% of adult patients were interested in tooth whitening, but only 5% of those actually received a whitening treatment. In the early 1990's, many people desired whiter teeth, but few acted on their desires. Barriers such as cost, time, trust in product safety, availability of product choices, and even being comfortable with the recommended product may have hindered a person's desire to undergo a procedure for whiter teeth. With ongoing research and safety well established for most whitening products, consumers have direct, easy access to whiter teeth. Many adults are interested in enhancing their appearance by choosing vital tooth whitening as a means of looking younger and/or better. With the aging U.S. population, interest in tooth whitening products is expected to escalate.

Reyto (1998) stated that cosmetic dentistry increases patients' self esteem and confidence, and one's awareness of the value of healthy teeth and gingiva, yet this opinion has not been validated. Once teeth are whitened, this clinical outcome might influence the person's interest in and value of his/her oral health and hence, augment oral self care and professional oral care seeking behaviors. The assumption is that if patients' consciousness about their oral health can be raised as a result of vital tooth whitening, and if they then value their oral appearance more than before whitening, then they might be inclined to seek dental care regularly. The specific aim of the present study was to determine if the use of a 21-day tooth-whitening product can influence people's interests in or value of their oral health. If so, then this cosmetic product may play an educational and motivational role in the overall dental hygiene care plan. The ultimate outcome of this change in client perception, interests and values might be a decrease in dental disease and a change in personal oral health behaviors that can lead to regular oral care seeking behaviors among those who experience tooth whitening.

Definition of terms

Several variable terms for the purpose of this study:

Vital tooth whitening- The self-applied process of using a professional strip product containing hydrogen peroxide as an active ingredient to significantly change tooth color to a lighter, whiter shade. Whitening occurs by using a polyethylene strip delivery system impregnated with a concentration of hydrogen peroxide, also referred to as whitening strips**. Tooth color was measured using a 12-point acrylic shade guide commonly used in dental offices. Color measurements were taken at baseline and at two-weeks and four weeks after baseline. The scale ranged from 1(A1) to 12(D4).

Oral health interest- Patient's self-reported level of concern or curiosity about his/her personal oral health. Interest was assessed by items 1, 4, 5, 6, 12, 13, 14, 16, 18, 21, and 22 in Part II of the *OHQ* (see Appendix B) administered at baseline and at two-week and four-week intervals after baseline.

Oral health value- The degree to which a person regards the importance of his/her oral hygiene and oral health. The level of value was measured by items 3, 7, 8, 9, 17, and 20 in Part II of the *OHQ* administered at baseline, and at two and four-week intervals after baseline.

Tooth color- The shade of the tooth. Colors in the acrylic shade guide ranged from A1-D4 with A1 being the lightest and D4, being the darkest. These shades were assigned scores of 1, lightest though 12, darkest were assigned to these labels and used for tooth color determination.

Assumptions

The following assumptions were made:

1. Whitening strips alter the shade of the participant's tooth color as a result of the recommended three-week regimen.
2. The clinical method of evaluating tooth shade differences in restorative dentistry is accurate and reliable for measuring tooth color change from vital

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**Crest Whitestrips® Supreme

tooth whitening.

3. Participants in the study complied with the three-week regimen and did not skip doses nor alter the time recommended by the manufacturer for whitening

strip usage.

4. Participants answered the questionnaire honestly and to the best of their knowledge.
5. Tooth whitening enhances adults' interest in and value of their oral health and oral-care behaviors.
6. People who have not whitened their teeth place lower priority on their oral health and oral-care behaviors compared to those who have experienced a vital tooth whitening regimen.

Figure 1. Whitestrips® Supreme and Instructions Flyer

Limitations

Internal and external validity of this clinical trial may be limited by the following:

1. The inability to have a probability sample taken from the population limits the ability

to generalize findings. Findings apply only to people who possess characteristics similar to those who completed the study.

2. External factors such as participation consumption of coffee, red wine and tea may have affected the outcome of the research. This limitation was minimized by randomizing participant treatments, having all of the participants use the same toothpaste and toothbrush to control extrinsic stain removal, and by excluding tobacco users from the study.
3. The self-designed questionnaire, *OHQ,* did not have established validity or reliability. This problem was minimized by having the questionnaire reviewed by a panel of experts and via a test-retest reliability procedure conducted during a pilot study (see Table 1).
4. The study was single blind in that the participants were able to determine their group status.

Hypotheses

The following hypotheses were tested at the .05 level:

1. There will be a statistically significant increase in adults' interest in their oral health from baseline to posttest as a result of a three-week whitening regimen, as measured by the *OHQ.*
2. There will be a statistically significant increase in adults' value of their oral health from baseline to posttest as a result of a three-week whitening strip regimen, as measured by the *OHQ.*
3. There will be statistically significant relationship between adults' tooth color and the value they place on their oral health.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review contains information on both over-the-counter and professionally-applied tooth whitening regimens; consumer satisfaction with tooth color;

oral health interests, attitudes, values, behaviors; orofacial attractiveness; and effectiveness of whitening products.

Consumer Satisfaction with Tooth Color

A smile is one of the most important human communication tools (Joiner, 2004). The mouth and dentition are important for speech, appearance and conveying emotions. Poor oral hygiene or discolored teeth can greatly affect the individual's presentation of self, self-esteem and confidence. Most patients and consumers desire a better smile and orofacial appearance. Joiner (2004) reported that 34% of Americans are dissatisfied with their current tooth color. Although people spend approximately 1.5 billion dollars a year on bleaching products, only 10% of people are happy with their tooth color (Ianzito, 2001). Blankenau, Goldstein and Haywood (1999) stated that the public has a high demand for whiter teeth, and that those between 40 and 50 years of age inquire about whitening the most often. In a study of 254 participants, it was revealed that women valued the appearance of their teeth more than men and younger people more so than older people (Blankenau et al. 1999). Most of the older population agreed that a functioning dentition was more important to them than an esthetically whiter dentition (Vallittu, Vallittu & Lassila, 1996). Joiner (2004) found that individuals who had fewer than two dental visits per year were less satisfied with their current tooth color than those who had two or more dental visits suggesting that those with better oral health may be more active in seeking dental care and therefore place higher value and interest in their oral health. In a British dental health survey, researchers found that 27% of adults were not happy with the appearance of their teeth. Their most common focus of dissatisfaction being tooth color (Bradnock, White, Nutall, Morris, Treasure & Pine, 2001).

Odioso, Gibb and Gerlach (2000) state that diet, health history, age, tobacco use, gender and race can affect tooth color. Their study included 180 individuals ranging from 13 to 64 years of age. Each participant was asked to describe the level of satisfaction of their tooth color on a five-point scale. Maxillary central incisors were assessed for tooth shade using a reflective spectroscopy which was calculated using L*a*b (L=light to dark, a= red to green, and b= yellow to blue). Result suggested that as age increased, tooth color became more yellow and brightness decreased. Participant satisfaction with tooth color had a relatively low mean score and only one-fifth of participants were satisfied with their current tooth color. The researchers concluded that the most significant influence on tooth color was age, with both intrinsic and extrinsic staining playing a role in tooth discoloration. Results suggest that patients have to be realistic regarding the tooth color achievable within their peer group, because having a whiter tooth color than found in a younger population is an impossible goal for those in older age groups (Odioso et al. 2000).

Joiner (2004) states that internal tooth staining is related to light scatter, the absorption properties of enamel and dentin, and is considered to be permanent. External tooth stain can be removed by cleaning and polishing methods, such as tooth brushing with a dentifrice, rubber-cup polishing with a light abrasive agent, or in some cases, by applying different types of hydrogen peroxide or carbimide peroxide whitening gels.

Joiner (2004) describes tools and methods to measure tooth shades, such as visual paper guides and acrylic resin shade guides. The most frequent type of tooth shade determination used by dental professionals is visual determination using a standard acrylic shade guide. This method requires the examiner to compare a tooth with a

standard shade, guide under the same lighting conditions; the client's tooth shade is then determined. Acrylic shade guides are known to be a cost-effective and efficient method to determine and monitor tooth color (Joiner, 2004).

Oral Health Interests, Attitudes, Values, Behaviors and Orofacial Attractiveness

A strong relationship exists between how people perceive the appearance of their teeth and their oral health attitudes (Ostberg, Halling & Lindlad, 2001). Those who feel a beautiful smile is important are more likely to strive to achieve such a smile; therefore, placing more importance on their oral health. Possessing cosmetically pleasing teeth might affect a person's oral health interests, values, and self-care behaviors, yet this relationship has not been consistently observed in the literature. There are strong associations between adults' attitudes and self-perceived oral health and this association should be seen by dental professionals as a strategy to promote oral health (Ostberg et al. 2001).

Griffiths (2002) evaluated patients' attitudes toward preventing oral diseases, the importance of regular three-month dental hygiene visits and compliance with oral hygiene instructions. Results revealed that 98% of the patients surveyed felt that they benefited in some way from seeing their hygienist, and 99% felt they had used or acted upon the oral hygiene instructions recommended by their hygienist (Griffiths, 2002). The study revealed a statistically significant relationship in the adult patient's perception of and compliance with recommended oral hygiene instructions from a dental hygienist. Moreover, most patients are receptive to professional instructions and comply with the self-care instructions that the dental hygienist provides (Griffiths, 2002). Given these findings, dental hygienists are likely to play a critical role in recommending whitening

procedures, particularly if the whitening procedure appears to improve a client's oral health behavior.

Blankenau et al. (1999) suggested that patients themselves do not know what type of restorative dentistry would be best for them, and that their desires and expectations regarding their oral health change overtime. The researchers also believe that whitening procedures attract new patients who may not otherwise seek therapeutic or restorative dental treatment. From Blankenau et al.'s point of view, whitening products have a desirable secondary effect, i.e., to motivate some patients to seek dental care for the first time in years. The dentally anxious or unmotivated person may view vital tooth whitening procedures as nonthreatening and noninvasive, therefore providing a reason to make a dental appointment, and an opportunity for the dental staff to provide client education and motivation for receiving other needed care (Blankenau et al. 1999).

In a study by Dunn, Murchison and Broome (1996), photos were taken of the smiles of eight males and eight females. The purpose of the study was to determine factors that distinguished attractive smiles from unattractive smiles as perceived by the general population. Sixteen photos that varied by tooth colors, number of teeth present, tooth height, and smile symmetry were shown to random shoppers at a military base mall. The shoppers were asked to rate the photos for overall appearance and attractiveness, as well as arrange them in ranking order, most to least attractive. Results showed that the same female, with natural teeth, light tooth shade, high lip, and good smile symmetry, was consistently chosen as most attractive. The two photos of females with the darkest tooth color consistently were seen as the least attractive. Results for the photos of males were similar. The photo with the lightest tooth color was consistently

chosen as the most attractive. Within all of the shoppers questioned, tooth color was the most important factor in dental attractiveness (Dunn et al. 1996). In all cases, regardless of gender, tooth color was the most important factor in perceived attractiveness. Tooth color along with other factors such as natural verses unnatural teeth and smile symmetry, played a role in a good-looking smile (Dunn et al. 1996).

Vallittu, Vallittu and Lassila (1996) focused on the relationship between different cultures of people and their attitudes towards dental aesthetics. The researchers assumed that both cultural and individual preferences can influence a person's attitude towards the appearance of their teeth. To determine how different population groups perceive dental aesthetics, a 13-item survey was constructed to collect data on personal opinions about the color of teeth, natural teeth verses prosthetic teeth, and appearance of teeth. Opinion statements were scored on a 5-point Likert scale, *strongly agree* to *strongly disagree,* respectively (Vallittu et al. 1996). Over a three month period, 254 patients from the Dental Clinic of the University of Kuopio in Finland, most of which had all their natural teeth, responded to the survey. Results showed that natural, white teeth are most beautiful to younger people, while older persons valued functioning teeth more than whiter teeth. More educated respondents preferred whiter teeth than those who were less educated, and women were more concerned with the appearance of their teeth than were men (Vallittu et al. 1996). The researchers concluded that well-educated, younger females placed a higher value on whiter, more natural looking teeth than other groups such as males, or the less educated.

Bradnock et al. (2001) questioned participants from England and Wales regarding their current dental habits, attitudes and behaviors, and compared these to a previous

British dental health study. The 1968 study found that 37% of adults were edentulous and only 49% indicated that they brush two times a day. Compared to the 1998 survey, only 12% of respondents were edentulous and 61% reported brushing two times a day. Researchers found that most adults have a growing interest in more aesthetically pleasing smiles and appearances, but only 23% of those adults go to the dentist on a regular basis. Bradnock et al. (2001) also asked if adults would prefer their front teeth to be extracted or restored. Most chose to restore their front teeth indicating a shift in their interest in maintaining a more pleasing smile as opposed to one replaced with dentures, the preferred choice documented by the 1968 British Dental Health Survey (Bradnock et al. 2001). Given the shifting trend towards a more favorable interest in a healthy, natural smile, 74% of adults report brushing their teeth at least once a day, with women reporting more frequent brushing than men (Bradnock et al. 2001). This study demonstrates the heightened interest in improving oral health and dentofacial appearance among adults, and also highlights the accelerating trend toward achieving a more cosmetically pleasing smile.

McGrath, Wong, Lo and Cheung (2005) compared oral health quality to tooth whitening. Eighty-seven participants were surveyed using the *Oral Health Impact Profile (OHIP)* which assessed the overall impact of oral health on ones' quality of life. Each participant completed the survey at baseline and were instructed to use a whitening product given to them by the researchers. This included toothpaste, whitestrips and paint-on whitening. After eight weeks, the participants returned to complete the survey again. Results revealed that most participants saw an increase in tooth brightness after using a whitening product. Results from questions related to tooth color from the *OHIP*

indicated that approximately 24% of the participants were more satisfied with their new tooth color. It was also found that a negative change in tooth color created an increased burden in life quality in respect to social disability; however, this change was very small (McGrath et al. 2005). This study reveals a strong relationship between tooth color and satisfaction as well as positive oral attitudes.

Alkhatib, Holt and Bedi (2005) aimed to link tooth color perception to socio-demographic factors such as age, education, income, smoking and dental visits. The researchers asked 496 participants, randomly selected from the United Kingdom Office for National Statistics Omnibus Survey, to choose a photo from a set of smiles that best matched their own tooth color by memory. The participants were also questioned regarding their socio-demographic characteristics such as age, education, income, smoking and regularity of dental visits. Findings revealed that 50% of the participants perceived they had normal tooth color and half of the participants believed they had some tooth discoloration; 13% reported moderate discoloration and less than 6% believed that they had severe tooth discoloration (Alkhatib et al. 2005). Respondents who had the most inaccurate perception of tooth color, or perceived their tooth color was the darkest shade, were older males with a low education, low income and few dental visits. Older participants had a less accurate perception of tooth color than younger participants and smokers also had a lower perception of tooth color. Females had the most accurately perceived tooth color which surprised the researchers, given that they hypothesized a lower perception from females. Upon more thought, the researchers believed that females have a higher interest in cosmetics and appearances, and might have already taken measures or notice of their tooth color characteristics (Alkhatib et al. 2005). Based

on these outcomes, the researchers concluded that the general population is concerned about their dental appearance in terms of tooth color. With this new discovery, tooth whitening products are sure to escalate in popularity; therefore, dental professionals should provide adequate patient education for those who seek vital tooth whitening (Alkhatib et al. 2005). Christensen (2005) forewarns that some patients can over-bleach their teeth by either using over-the-counter or dentist supervised bleaching regimens. Christensen recommends that individuals should be informed about the possible side-effects of bleaching, possible re-occurring tooth stain, and advised to refrain from over-bleaching (Christensen, 2005). Ianzito (2001) reported on several types of over-the-counter and in-office bleaching methods. Ianzito (2001) warned that consumers should be evaluated by a dentist prior to beginning any whitening treatment and cautions about the risk of over-bleaching and "fake" looking smiles.

Effectiveness of Vital Tooth Whitening Products

According to Gerlach, Gibb and Sagel (2000), whitening is

> "...one of the most common elective dental procedures embraced by patients and clinicians because of the tangible esthetic benefits along with various intangibles, such as heightened self-esteem, improved oral hygiene and increased patient involvement in dentistry."

Bleaching has been used as a tooth whitening method for decades and 90% of patients who experience bleaching see positive results; however, the degree of change in self esteem and patient involvement in dentistry as a result of tooth whitening has yet to be validated via research.

Gerlach, Gibb, and Sagel (2000) used a sample of 36 adults who had no history of tooth bleaching or restorations on the anterior teeth to test the effectiveness of four

whitening regimens. Each participant was assigned to one of four groups: whitening strip with 5.3% hydrogen peroxide; 10% carbamide peroxide used with a tray; 15% carbamide peroxide used with a tray; or 20% carbamide peroxide used with a tray. At the second and seventh day of use, the oral tissues and gingiva were examined. At day 14 (final day of use), the oral tissues were re-examined. Results revealed an overall improvement in tooth color in the maxillary and mandibular anteriors; the most significant improvement from the 20% carbamide peroxide group; however, the strip method was found to be equal to the 10% carbamide peroxide group (Gerlach et al. 2000). All subjects reported slight to mild gingival and oral irritation, but only those who used a traditional tray system experienced tooth sensitivity. Tooth color results were more consistent in the subjects who used the strips compared to those who used the trays. Individuals who used the strips were more likely to comply with the recommended regimen due to the level of comfort and ease of use compared to the subjects using a tray system. Although the researchers found the strip method of bleaching to be as effective as a tray method, they concluded that the strip method was preferred for patient comfort, ease of use and satisfaction (Gerlach et al. 2000). Although some patients experienced sensitivity and gingival irritation, despite these side effects, they continued to bleach their teeth (Gerlach et al. 2000). Evidence supports that over-the-counter, tooth whitening strip technology changes tooth color, although age and extrinsic factors such as food, coffee, red wine and tobacco can affect the longevity of tooth color change. Patients are satisfied with the tooth color results that follow a bleaching regimen and many retain the effects of bleaching for several years. Whitening strips have shown to expand consumer

access to a bleaching product, with heightened convenience and ease in product use (Gerlach et al. 2000).

Blankenau et al. (1999) stated that Dr. Goldstein, a practicing dentist, used whitening procedures in his office for years, and prior to a whitening treatment, would assess current tooth color in terms of yellow, brown or blue-gray. This assessment is important to the treatment outcome because patients with more yellow teeth tend to get a better result from both in-office and home treatment, while those with more brown color find better results with an in-office treatment. Persons with blue-gray color find it more difficult to achieve a whiter color; therefore, Goldstein suggests that these patients begin with an in-office procedure and follow up with home treatments, either using a tray system or over-the-counter whitening strips (Blankenau et al.1999).

Since 2000, when first introduced, Crest Whitestrips® have gained popularity and spawned increased interest in whitening, access to cosmetic procedures and further dental treatment. According to Gerlach (2002), Crest Whitestrips® were the product that was the "most successful first-year initiative of its kind in oral care," and the more convenient and accessible method for those who choose tooth whitening, as opposed to traditional bleaching methods such as at-home bleaching trays. Yet despite its success, little is known about how the product affects consumers' oral health values, or if having whiter teeth alters a person's oral health awareness or interest.

A study was conducted to evaluate the safety and efficacy of Crest Whitestrips® Supreme with 14% hydrogen peroxide (Garcia-Godoy, Villalta, Barker & Gerlach, 2004). Thirty-nine volunteers were randomly placed into two groups; 19 in the testing group and 20 in the placebo group. For six weeks the participants used the whitening

strips two times a day, 30 minutes each time. Researchers found that the tested whitening strips significantly improved tooth color and brightness in the test group compared to the placebo group (Garcia-Godoy et al. 2004). Tooth sensitivity and tissue irritation were the most common side effects of all which subsided upon completion of the study. Un-anticipated effects were the comments from the participants and others such as, "have you whitened your teeth?" Researchers concluded that Crest Whitestrips® Supreme with 14% peroxide are safe and effective (Garcia-Godoy et al. 2004).

A report by Sagel and Landrigan (2004) stated that high concentrations of whitening gel can result in whiter teeth at a faster rate, but it also increases the chance of gingival irritation. Crest Whitestrips® Professional launched in 2000, contains 6.5% hydrogen peroxide. Crest Whitestrips® Supreme launched in 2004, contains 14% hydrogen peroxide but with only half the amount of gel as the 6.5% peroxide strip (Sagel & Landrigan, 2004). The researchers found that decreasing the amount of gel on the strip while using a higher peroxide concentration would result in better whitening with less gingival irritation.

Gerlach (2004) reported that the Crest Whitestrips® Supreme were an easy-to-use whitening procedure with better expectations and faster whitening results. Gerlach goes on to state "...these novel strips represent yet another shift in conventional thinking on tooth whitening... increasing peroxide concentration was believed to positively impact on efficacy, while negatively impacting on tolerability" (Gerlach, 2004).

Auschill, Hellwig, Schmidale, Sculean and Arweiler (2005) tested three different bleaching techniques, (1) whitestrips, (2) at-home tray bleaching and (3) in-office laser bleaching for efficacy, side-effects and patient acceptance. This study differs from

Gerlach (2002) and Sagel et al.(2004) in that it did not test the effectiveness of whitening in a defined time period; rather it set a determined final shade and tested to see if all three types of products would yield the same shade (Auschill et al. 2005). Thirty-nine volunteers were randomly placed in one of three groups, and each used the whitening regimen assigned to them-Crest Whitestrips® (over-the-counter) for 30 minutes twice a day (group 1) Opalescence™ PF (at-home) for 8 hours (group 2), and Opalescense™ Xtra Boost (in office) for 15 minutes (group 3). Patients were questioned regarding the possible side effects encountered, e.g., tooth sensitivity, gingival irritation and their acceptance of the regimen after the treatment was finished. Study models were fabricated from each volunteer prior to and after whitening to determine if any enamel changes had taken place. From the study models, no observable enamel surface texture changes were detected. All three products yielded the desired final tooth color, but the higher the concentration of the active ingredient, the faster the result. Although volunteers' reported side effects such as slight gingival irritation and tooth sensitivity, all side effects subsided upon completing the whitening product. Patient acceptance for all products was high (Auschill et al. 2005).

Gerlach and Sagel (2004) tested two different concentrations of Crest Whitestrips®-one with 14% peroxide, and the other with 6% peroxide as well as different thicknesses of the peroxide gel on the strips: (0.10mm and 0.20mm). Thirty-eight subjects used the strips for two weeks, 30 minutes a day on the maxillary teeth only. The experimental group used the 14% peroxide concentration with the thinner gel thickness at 0.10mm and the control used the 6% peroxide concentration with the thicker gel thickness at 0.20mm. Data revealed found that using the 14% peroxide concentration in

a thinner gel resulted in 42% to 49% greater whitening compared to the thicker gel on a strip. Both groups reported similar side effects such as gingival irritation and slight sensitivity (Gerlach & Sagel, 2004). The researchers concluded that the thinner gel concentration yields a faster and more effective whitening result and that the thin gel can be beneficial to patients who experience gingival irritation from conventional whitening gels (Gerlach & Sagel, 2004).

This review of the literature established common ground regarding tooth whitening and its potential relationship to oral health interests and values. From past research, it was found that using a peroxide-based gel with a concentration range of 6% to 16% applied to the teeth can increase the whiteness of one's teeth. Tooth whitening can increase ones' satisfaction with their appearance and most people find a whiter smile more attractive than one with darker teeth. Within the past decade there has been an influx of interest about tooth whitening methods and people have begun to actively seek out a more attractive smile through tooth whitening products and procedures. Dental hygienists play a significant role in educating patients about bleaching alternatives and can introduce whitening products at oral care maintenance appointments. Furthermore, patients respond affirmatively to the dental hygienists' recommendations and dental hygienists appears to be able to influence the oral self-care behaviors of their patients. Whether over-the-counter tooth-whitening products can change peoples' oral health interests and values has yet to be determined. Dental hygienists may apply this information in the clinical setting to promote better oral hygiene, oral health, and perhaps psychosocial outcomes for patients. Findings from tooth whitening studies might help dental professionals and consumers achieve satisfying dentofacial appearances, greater

interest in oral health, and stronger oral health values.

CHAPTER III

METHODS AND MATERIALS

Research Design

This two group, randomized clinical trial was designed to assess the interest and value adults place on their oral health prior to and after using a 21-day tooth whitening regimen. To determine adults' initial oral health interests and values, the *OHQ* was administered at baseline. The same questionnaire was re-administered at two and four-

weeks after baseline to determine changes in participants' oral health interests and values overtime. The treatment group utilized the 21-day whitening regimen, whereas, the control group used no whitening regimen. To minimize the threat to validity and reliability, the *OHQ* was administered to ten individuals, as a pilot test prior to the beginning of the study. This method reduces the instrumentation threat to internal validity because stability of measurement overtime could be documented (Locke, Silverman & Spirduso, 2004).

The pilot test revealed no significant change in the participants' responses occurred from baseline to two-weeks (see Table 1). The ten individuals were not exposed to the experimental variable of tooth whitening; therefore, their answers should not have changed significantly. This result documented the stability of the questionnaire measure, thus increasing the reliability (Royeen, 1989). No changes were made to the *OHQ* due to the pilot test results.

Table 1. Percentage of Answers that Remained Unchanged from Baseline to Post-test within the Pilot Study Group (n=10)

Question	Reliability
1	100%
2	87.5%
3	100%
4	100%
5	75%
6	100%
7	100%

8	87.5%
9	87.5%
10	62.5%
11	62.5%
12	87.5%
13	87.5%
14	75%
15	87.5%
16	100%
17	100%
18	100%
19	75%
20	87.5%
21	75%
22	100%

The actual study utilized a two-group, randomized, pretest-multiple post-test design (see Table 2). Sixty individuals were randomly assigned by a research assistant to one of two groups using a table of random numbers; only the research assistant knew each subject's group status. This single-blind design allowed the researcher to objectively measure tooth color and administer the *OHQ* to determine participants' oral health interest and values at baseline, two-weeks during the whitening regimen and one-week after the whitening regimen. The independent variable was the use of the three-week whitening strips (14% hydrogen peroxide); the dependent variables were the participants' oral health interests and values and their tooth color.

Table 2. Two-Group, Randomized Participants, Pretest/Multiple Post-test Design

PRETEST/BASELINE	INDEPENDENT VARIABLE	2 WEEKS AFTER BASELINE	4 WEEKS AFTER BASELINE
Experimental Group Tooth Color Measure *Oral Health Questionnaire* n=22	Whitening Strip Use for 3 weeks	*Oral Health Questionnaire*	Tooth Color Measure *Oral Health Questionnaire*
Control Group Tooth Color Measure *Oral Health Questionnaire* n=28	No Whitening Products Used for 3 weeks	*Oral Health Questionnaire*	Tooth Color Measure *Oral Health Questionnaire*

Both the experimental and control groups were given in both written and oral form, the same oral hygiene instructions, given in both written and oral form, and provided with the same type of toothbrush (Crest® triple-effect), toothpaste (Crest® cavity protection), and floss (GUM® mint waxed) (see Appendix C and Figure 2). Participants were instructed to brush two times daily for two minutes during each brushing session, floss once each day, and refrain from using power toothbrushes, which are known to effectively remove extrinsic stain. For example, power toothbrushes remove stain from black tea and chlorhexidine rinses more effectively than manually-activated toothbrushes when used at home for long periods of time (Moran et al. 2004). For three weeks, the experimental group used the whitening strips twice daily following the manufacturers directions found in each whitening strips box. During this time, the control group received no whitening treatment. Each participant returned for an oral examination to assess tooth color changes, as well as to complete the *OHQ* two and four-weeks after baseline.

The major limitation of this research design was a possible pretest x-interaction effect, Hawthorne effect, short time frame, and participants' knowledge of their group status; however, the research team believed that a longer study using a Solomon-three group design would have been too expensive and a placebo polyethylene strip could not be obtained from the manufacturer. The random assignment of participants to groups controlled for most of the unknown extraneous variables.

Sample Description

To recruit participants, a recruitment flyer was electronically posted on the Old Dominion University e-mail announcement system available to students, faculty and staff. Flyers were also posted around the Old Dominion University campus (see Appendix F). A convenience sample of 60 adult males and females between the ages of 18 to 60 who met the inclusion and exclusion criteria were enrolled. This initial sample was representative of the general population interested in tooth whitening and who would most likely purchase a bleaching product. The initial sample size of 60 participants was adequate to generalize findings back to the general population, allowed for subject attrition, and was appropriate for parametric statistical analysis. To qualify, a participant must have had at least eight of the twelve anterior teeth, none of which could have been restored with composite restorations, veneers, or crowns. Those who were excluded from the study included people who:

- had nonvital anterior teeth
- were pregnant or lactating
- smoked or used spit-tobacco products, and
- had never used any type of bleaching regimen, either over-the-counter or professional, except for whitening toothpaste.

Interested adults were prescreened over the telephone regarding the established inclusion/exclusion criteria (see Appendix E). Individuals who qualified were scheduled for a pre-study screening appointment to verify that they met the inclusion criteria and did not possess any of the exclusion criteria (see Appendix D). Those who met the study criteria were invited to participate; the study was explained verbally to each participant individually. Each participant then signed the consent form in duplicate indicating knowledge of all potential risks and their willingness to participate (see Appendix A). Sixty individuals were enrolled, 68% (n=34) females and 32% (n=16) males. In terms of age, the largest group represented was those who were 18 to 29 years (52%; n=26) and the smallest represented group was 40-49 years (10%; n=5). In terms of race, 50% (n=25) of the participants were Caucasians, 38% (n=19) African American and only 8% (n=4) from Asian descent. Of the participants, 70% (n=35) had a dental examination within the past year, but 18% (n=9) only sought dental care if they had a dental problem. With attrition, the final sample consisted of 50 volunteers (18 men, 32 women) ranging from 18-60 years of age; therefore, findings should only be generalized to persons with similar characteristics (see Table 3).

Table 3. Demographic Profile of the Final Participants (n=50)

	Whitening Group (n=22)	Non-Whitening Group (n=28)
GENDER		
Male	10	8
Female	12	20
AGE		
18-29	12	14
30-39	4	6
40-49	2	3

50-60	4	5
RACE		
Caucasian	13	12
African-American	5	11
Hispanic	0	2
Asian	2	2
American Indian or (Native Alaskan)	1	0
Other	1	1
MARITAL STATUS		
Married	8	11
Single	13	14
Divorced/Separated	1	3
Widow(er)	0	0
ANNUAL INCOME		
< 10,000	7	7
10,000-19,999	2	7
20,000-29,999	2	3
30,000-39,999	3	3
40,000-49,999	2	4
50,000-59,999	1	0
60,000- or more	2	4
Unemployed	3	0
DENTAL APPOINTMENT (within past year)		
Yes	14	19
No	8	9
DENTAL RECARE		
Dental problem	3	7
Every 6 months	10	14
Once a year	4	7
Every few years	5	0
Never	0	0
ATTRITION	8	2

All participants, regardless of experimental or control group status, were provided with the same toothbrush, non-whitening toothpaste, floss and written oral hygiene instructions (see Figure 2 and Appendix C).

Figure 2. Oral Hygiene Aids Given to All Participants

Procedures, Materials and Data Collection Instruments

Once 60 individuals were enrolled, subject recruitment stopped and the participants were randomly assigned to one of two groups. At baseline, participants were assessed via the *OHQ* which consisted of a series of statements soliciting opinions about their own oral health status specifically in areas of tooth color, oral health interest, oral health values, oral hygiene practices and dental care seeking behaviors. Each statement was assessed using a Likert scale of "*strongly agree, agree, no opinion, disagree* and *strongly disagree.*" A brief health history and a visual oral examination using a tongue depressor were conducted on each participant to verify possible contraindications to tooth whitening as reflected in the exclusion criteria. Baseline tooth color was assessed from tooth numbers 6 through 11 and 22 through 27. The teeth were dried using cotton gauze;

tooth color was scored using a 12-point VITA shade guide without a dental light. Colors on the shade guide ranged from A1 to D4, with A1 being the whitest, and D4 being the darkest.

Each participant was given standardized verbal and written instructions regarding the use of the whitening strips, information on potential adverse effects, how to report problems to the researchers, and what to avoid while participating in the study. Individuals in the experimental group received one box of whitening strips, a toothbrush, toothpaste, floss, and oral hygiene instructions (see Appendix C and Figure 2). The control group received only the toothbrush, toothpaste, floss and oral hygiene instructions. The researcher, a dental hygienist, who administered the questionnaire and tooth color assessment, was blind to individuals' group status. A research assistant distributed the whitening strips and oral hygiene supplies as well as provided, oral hygiene instructions to the participants based on their group status to maintain the blind conditions. Two weeks following the start of the study, participants returned for a visual oral exam with a tongue depressor, and to complete the first post- *OHQ* to determine changes in their personal oral health interests and values. An oral examination was performed to determine any adverse effects on oral tissues; tooth color was not assessed at this time. Participants returned again at four-weeks post baseline for a final tooth color assessment, visual oral examination and final completion of the *OHQ*. Assessments were conducted by the same dental hygiene researcher. Data conducted at each visit were recorded on the services rendered form and maintained in each participant's casebook (see Appendix H).

Protection of Human Participants

The protocol and plan for the protection of human participants was reviewed by the Old Dominion University Institutional Review Board (IRB) and approved on February 16, 2006.

Potential Risks. Some potential risks that participants may have encountered when using the product included irritation to the gingiva and or tooth sensitivity due to the 14% hydrogen peroxide concentration. The gingival irritation and tooth sensitivity should have subsided upon completion of the whitening strips regimen. These side effects were printed in the manufacturer's brochure found inside each package of white strips. For each individual, the researchers maintained a record of any adverse reactions and reported these to the Institutional Review Board (see Appendix G). One participant from the whitening group discontinued the study due to sensitivity; however, no medical or dental care was required. In total 10 people withdrew for various reasons (8 from the whitening group, 2 from the control group).

Consent Procedures. Informed consent was achieved by explaining the study to the participants and requiring all volunteers to sign an informed consent form. The principal investigator or research assistant explained verbally and in writing, the materials to be used, the protocol of the study and any potential risks that could be encountered. Consent was obtained at the prescreening appointment.

Protection of Participants' Rights. The participants' rights were protected by obtaining the required informed consent and informing participants of potential risks of using the white strips product. Confidentiality was maintained by refraining from publishing any names of participants. Data were kept in a locked file cabinet within the Dental Hygiene Research Center and reported in aggregate form only. No data collection

forms had a participant's name associated with it. Subject data collection forms only contained a subject code for tracking the data.

Potential Benefits. Potential benefits of this study included a significant change in tooth color to a whiter and brighter shade. Participants could have increased their knowledge of tooth whitening and explored other options for maintaining their new tooth color. Participants could have also experienced an increase in their oral health values and interests in maintaining good oral hygiene habits and optimal oral health. Participants were informed that they may be in a control or experimental group. If they were in the control group, at the end of the study, they received a box of whitening strips for their personal use.

Risk-Benefit Ratio. In this study, benefits outweighed the risks because most risks were only temporary and anticipated, such as dentinal hypersensitivity, sore throat and gingival irritation. These side effects should have subsided after a few days or upon discontinuation of the whitening strips. The potential risks were limited and not all individuals experienced them. In contrast, the benefit of whiter teeth could have provided the subject with an oral health consciousness raising experience, increased satisfaction with their dentofacial appearance, and augmented knowledge of, interest in, and value of their personal oral health. The effects of bleaching have been known to last up to a year. **Statistical Analysis**

Given that participants were randomly assigned to groups and that data are at least intervally scaled, parametric procedures were used to analyze data. Percentages were used to describe the participants' oral health interests and values at baseline, at the two post-test intervals and to describe change observed overtime. Generalized linear models

were used because the same participants were asked the same questions repeatedly overtime. The Wald-Chi Squared was used to determine significant relationships between oral health values and degree of tooth color change, interest in oral health and degree of tooth color change, as well as associations between tooth color and the value adults place on their overall oral health. Significance levels were set at p= .05.

CHAPTER IV
RESULTS AND DISCUSSION

Participants answered the *OHQ* prior to and two times after baseline data collection: pre-test, two-week post-test and four-week post-test (also referred to as the final post-test). Although the researchers started with 60 participants, a total of 50 subjects completed the study, with 22 in the experimental group and 28 in the control group.

Only one participant chose to drop out due to tooth sensitivity from the whitening product; no medical or dental treatment services were needed. Other participants withdrew from the study because of time constraints or disinterest, and one participant moved out of the geographical area. Perhaps more experimental group participants withdrew because they received the whitening product at the beginning of the study, and felt no commitment to remain in the study; the control group participants had to wait until the final post-test to receive their whitening product.

Results

Hypothesis One. This hypothesis predicted a statistically significant increase in adults' oral health interest at baseline, at two-weeks after baseline and again at four-weeks after baseline, as measured by the *OHQ* (see Appendix B). Responses to the Likert scale for each item were summed and analyzed. A Wald-Chi Squared test was applied to the average score for questionnaire items from pre-test to post-test and for group differences reflecting interest items: 1, 4, 5, 6, 12, 13, 14, 16, 18, 21 and 22 (see Table 4). Analysis revealed both the experimental and control groups experienced statistically significant increases in their oral health interest from baseline to four-weeks after baseline for items 1, 4, 12, 18 and 22 (see Table 4 and Figure 3). Key questions related to interest which revealed the greatest amount of change from the *strongly disagree/disagree/neutral* to the *strongly agree/ agree* categories follow:

- item 1, *I would rate my oral health as excellent.*
- item 4, *I brush my teeth at least twice a day.*
- item 12, *I actively seek care from a dentist on a routine basis.*
- item 18, *I am interested in my oral health.*

- item 22, *I perceive my oral health to be good.*

Table 4. Significant Pretest to Post-test Within Group Differences and Significant Between Group Differences on Oral Health Interest Items 1, 4, 12, 18 and 22 of the *Oral Health Questionnaire.*

Item	Effect	DF	WaldChiSq	ProbChiSq (P-value)
1	Time	1	5.1615	0.0231
4	Time	1	5.1637	0.0231
12	Group	1	4.5333	0.0332
12	Time	1	3.9628	0.0465
18	Group	1	4.0128	0.0452
18	Time	1	5.2141	0.0224
22	Time	1	5.1415	0.0234

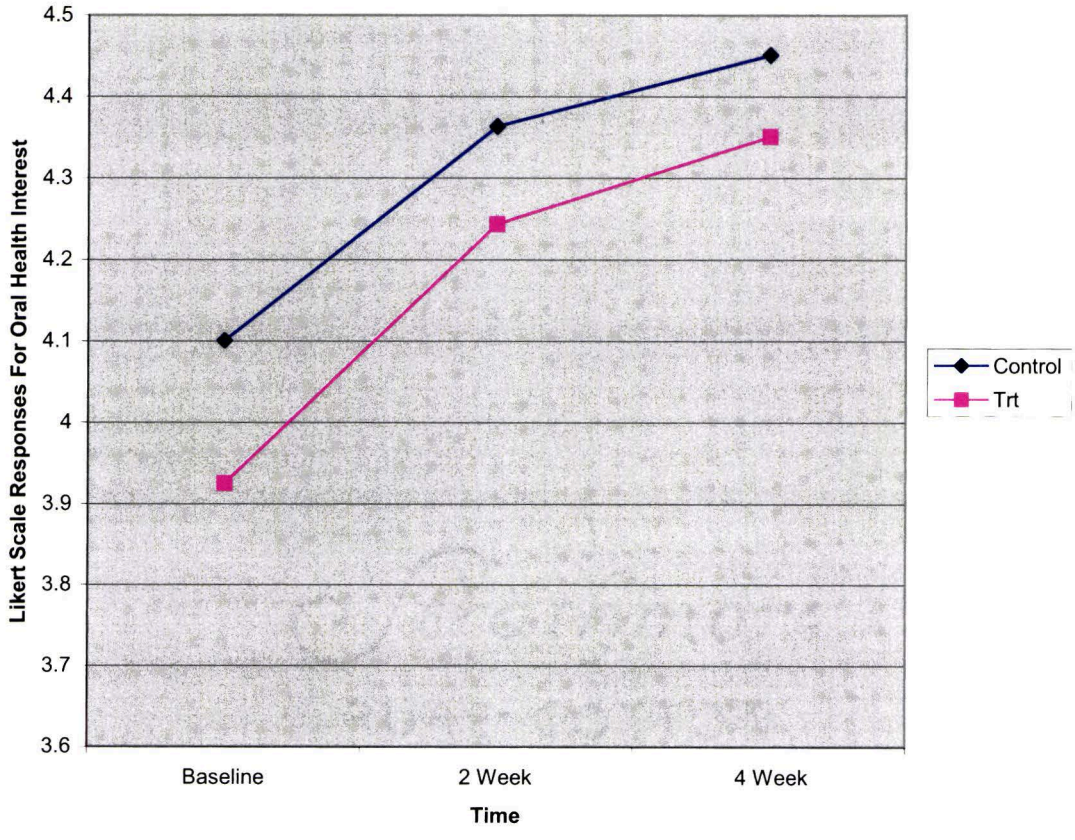

Figure 3. Between and Within Group Differences in Mean Oral Health Interest Scores Over time

Change in interest can be observed by comparing the percentage responses given in both experimental and control groups (see Tables 5-A through 10-D; significant findings are bolded in tables) and the degree to which those pooled *strongly agree/agree* (SA/A) responses increased from baseline to the final post-test in items 1, 4, 12, 18 and 22.

In item 1, *I would rate my oral health as excellent,* both the control group and experimental groups showed statistically significant change over time ($X^2 = 5.16$, df=1, p.=02). Both groups increased by at least 6 percentage points over time. The control group experienced a 7 percentage points improvement from baseline (10.7%) to final post-test (17.9%), the experimental group experienced a 22.7 percentage points improvement from baseline (45.4%) to the final post-test (68.1%) in the *strongly agree/agree* category indicating that although both groups increased in the number of adults who *strongly agree/agree* that their oral health was excellent, more people who whitened their teeth viewed their oral health as excellent.

There was a statistically significant change over time in item 4, *I brush my teeth at least twice a day,* for both groups ($X^2 = 5.16$, df=1, p=0.02). In the control group, baseline was 53.5% with an increase at final post-test to 60.7%. In the experimental group, baseline started at 45.4% and increased to 72.7% at final post-test indicating that the majority of participants increased brushing to at least twice a day and that those who whitened their teeth reported the biggest increase in brushing behavior. For item 12, I *actively seek care from a dentist on a routine basis*, there was a statistically significant

difference at post-test ($X^2 = 4.5$, df=1, p=0.03) and a statistically significant improvement from baseline to post-test ($X^2 = 3.9$, df=1, p=0.05), for both groups. In the control group, baseline started at 35.7% in the *strongly agree/agree* category and increased to 50% at final post-test; the experimental group started at 22.7% at baseline and increased to 27.2% at the final post-test indicating that both groups increased their dental care seeking on a regular basis. The control group had more adults who shifted into the *strongly agree/agree* category for increased dental care seeking behavior than the experimental group by at least 5%.

Item 18, *I am interested in my oral health,* had a similar outcome with a statistically significant difference between the groups at post-test (X^2 =4.0, df=1, p=0.04), and a statistically significant increase of both groups over time (X^2 =5.2, df=1, p=0.02). The control group had a higher response by 1.5% compared to the experimental group. Item 22, *I perceive my oral health to be good,* revealed a statistically significant increase over time in both groups (X^2 =5.1, df=1, p=0.02); the control group increased from baseline (7.1%) to final post-test (28.6%) by 21.5 percentage points. The experimental group increased from baseline (9.1%) to the final post-test (18.2%) by 9.1 percentage points. Although not statistically significant, item 5 showed that the control group improved from baseline (14.3%) *strongly agree/agree* to 39.3% at the final post-test, reflecting a 25 percentage point increase in valuing flossing behavior. Item 16, *I am interested in seeking dental care*, shifted 23.2% points from baseline (44.7%) to final post-test (67.9%). Item 21, revealed a 50 percentage point increase from baseline (17.9%) to the last post-test (67.9%). Within the experimental group, there was a 36.1% point increase from baseline (27.2%) to the final post-test (63.6%), indicating that both

groups of participants began to floss at least 2-3 times per week as a result of their involvement with the study.

Table 5-A. Percentage Responses to the Pretest Interest Questions for the Control Group (n=28)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**10.7**	**53.5**	**10.7**	**14.3**	**3.5**
4. I brush my teeth at least twice a day	**53.5**	**32.1**	**0.00**	**10.7**	**3.5**
5. I floss at least once a day	**14.3**	**35.1**	**14.3**	**28.6**	**10.7**
6. I understand why I have to clean my teeth	71.4	28.6	0.00	0.00	0.00
12. I actively seek care from a dentist on a routine basis	**35.7**	**35.7**	**3.5**	**14.3**	**7.1**
13. I am interested in having good oral hygiene habits	78.6	21.4	0.00	0.00	0.00
14. I am interested in knowing how to keep my teeth healthy	78.6	21.4	0.00	0.00	0.00
16. I am interested in seeking dental care	**44.7**	**37.3**	**14.4**	**3.6**	**0.00**
18. I am interested in my oral health	**57.1**	**32.1**	**10.7**	**0.00**	**0.00**
21. I floss my teeth at least 2-3 times per week	**17.9**	**39.3**	**7.1**	**21.4**	**7.1**
22. I perceive my oral health to be good	**7.1**	**57.4**	**10.7**	**21.4**	**3.5**

Table 5-B. Percentage Responses for the First Post-test Interest Questions for the Control Group (n=28)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**14.3**	**50.0**	**14.3**	**21.4**	**0.00**
4. I brush my teeth at least twice a day	**67.9**	**32.1**	**0.00**	**0.00**	**0.00**
5. I floss at least once a day	**42.9**	**35.7**	**7.1**	**10.7**	**3.5**
6. I understand why I have to clean my teeth	85.7	14.3	0.00	0.00	0.00
12. I actively seek care from a dentist on a routine basis	**46.4**	**32.1**	**7.1**	**14.3**	**0.00**
13. I am interested in having good oral hygiene habits	78.6	17.9	3.5	0.00	0.00
14 .I am interested in knowing how to keep my teeth healthy	75.0	25.0	0.00	0.00	0.00
16. I am interested in seeking dental care	**53.6**	**28.6**	**14.3**	**3.5**	**0.00**
18. I am interested in my oral health	**78.6**	**21.4**	**0.00**	**0.00**	**0.00**
21. I floss my teeth at least 2-3 times per week	**75.0**	**21.4**	**3.5**	**0.00**	**0.00**
22. I perceive my oral health to be good	**10.7**	**46.4**	**17.9**	**25.0**	**0.00**

Table 5-C. Percentage Responses for the Final Post-test Interest Questions for the Control Group (n=28)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**17.9**	**57.1**	**10.7**	**10.7**	**0.00**
4. I brush my teeth at least twice a day	**60.7**	**39.3**	**3.5**	**0.00**	**0.00**
5. I floss at least once a day	**39.3**	**35.7**	**14.3**	**10.7**	**0.00**
6. I understand why I have to clean my teeth	78.6	21.4	0.00	0.00	0.00
12. I actively seek care from a dentist on a routine basis	**50.0**	**32.0**	**14.3**	**3.5**	**0.00**
13. I am interested in having good oral hygiene habits	78.6	21.4	0.00	0.00	0.00
14. I am interested in knowing how to keep my teeth healthy	75.0	25.0	0.00	0.00	0.00
16. I am interested in seeking dental care	**67.9**	**25.0**	**3.5**	**3.5**	**0.00**
18. I am interested in my oral health	**71.4**	**25.0**	**3.6**	**0.00**	**0.00**
21. I floss my teeth at least 2-3 times per week	**67.9**	**35.7**	**14.3**	**0.00**	**0.00**
22. I perceive my oral health to be good	**28.6**	**50.0**	**14.3**	**7.1**	**0.00**

Table 5-D. Percentage Point Change from Baseline to Final Post-test for Interest Questions for the Control Group (n=28)

	Baseline	Final Posttest	% Point

	SA/A	SA/A	Change
1. I would rate my oral health as excellent	**10.7**	**17.9**	**7.2**
4. I brush my teeth at least twice a day	**53.5**	**60.7**	**7.2**
5. I floss at least once a day	**14.3**	**39.3**	**25.0**
6. I understand why I have to clean my teeth	71.4	78.6	7.2
12. I actively seek care from a dentist on a routine basis	**35.7**	**50.0**	**14.3**
13. I am interested in having good oral hygiene habits	78.6	78.6	00.0
14. I am interested in knowing how to keep my teeth healthy	78.6	75.0	3.6
16. I am interested in seeking dental care	**57.1**	**71.4**	**14.3**
18. I am interested in my oral health	**40.9**	**63.6**	**22.7**
21. I floss my teeth at least 2-3 times per week	**17.9**	**67.9**	**50.0**
22. I perceive my oral health to be good	**7.1**	**28.6**	**21.5**

Table 6-A. Percentage Responses to the Pretest Interest Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**13.6**	**45.4**	**13.6**	**27.2**	**0.00**
4. I brush my teeth at least twice a day	**45.4**	**27.2**	**9.1**	**13.6**	**4.5**
5. I floss at least once a day	**18.2**	**18.2**	**13.6**	**36.3**	**13.6**
6. I understand why I have to clean my teeth	72.7	22.7	0.00	0.00	4.5
12. I actively seek care from a dentist on a routine basis	**22.7**	**31.8**	**13.6**	**27.2**	**4.5**
13. I am interested in having good oral hygiene habits	59.0	40.9	0.00	0.00	0.00
14. I am interested in knowing how to keep my teeth healthy	59.0	40.9	0.00	0.00	0.00
16. I am interested in seeking dental care	**31.8**	**40.9**	**13.6**	**4.5**	**0.00**
18. I am interested in my oral health	**40.9**	**40.9**	**13.6**	**4.5**	**0.00**
21. I floss my teeth at least 2-3 times per week	**27.2**	**37.3**	**0.00**	**18.2**	**13.6**
22. I perceive my oral health to be good	**9.1**	**54.5**	**22.7**	**13.6**	**0.00**

Table 6-B. Percentage Responses to the First Post-test Interest Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**13.6**	**63.6**	**13.6**	**4.5**	**0.00**
4. I brush my teeth at least twice a day	**63.6**	**36.3**	**0.00**	**0.00**	**0.00**
5. I floss at least once a day	**31.8**	**50.0**	**4.5**	**13.6**	**0.00**
6. I understand why I have to clean my teeth	81.8	18.2	0.00	0.00	0.00
12. I actively seek care from a dentist on a routine basis	**27.2**	**45.4**	**13.6**	**9.1**	**4.5**
13. I am interested in having good oral hygiene habits	50.0	50.0	0.00	0.00	0.00
14. I am interested in knowing how to keep my teeth healthy	50.0	45.4	4.5	0.00	0.00
16. I am interested in seeking dental care	**54.5**	**45.4**	**0.00**	**0.00**	**0.00**
18. I am interested in my oral health	**63.6**	**31.8**	**4.5**	**0.00**	**0.00**
21. I floss my teeth at least 2-3 times per week	**54.5**	**36.6**	**0.00**	**9.1**	**0.00**
22. I perceive my oral health to be good	**9.1**	**63.6**	**9.1**	**13.6**	**4.5**

Table 6-C. Percentage Responses to the Last Post-test Interest Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
1. I would rate my oral health as excellent	**18.2**	**68.1**	**9.1**	**4.5**	**0.00**
4. I brush my teeth at least twice a day	**72.7**	**27.2**	**0.00**	**0.00**	**0.00**
5. I floss at least once a day	**22.7**	**72.7**	**0.00**	**4.5**	**0.00**
6. I understand why I have to clean my teeth	77.2	22.7	0.00	0.00	0.00
12. I actively seek care from a dentist on a routine basis	**27.2**	**54.5**	**4.5**	**13.6**	**0.00**
13. I am interested in having good oral hygiene habits	54.5	45.4	0.00	0.00	0.00
14. I am interested in knowing how to keep my teeth healthy	59.0	40.9	0.00	0.00	0.00
16. I am interested in seeking dental care	**36.6**	**45.4**	**0.00**	**0.00**	**0.00**
18. I am interested in my oral health	**63.6**	**36.3**	**0.00**	**0.00**	**0.00**
21. I floss my teeth at least 2-3 times per week	**63.6**	**27.2**	**0.00**	**0.00**	**4.5**
22. I perceive my oral health to be good	**18.2**	**59.0**	**9.1**	**13.6**	**0.00**

Table 6-D. Percentage Point Change from Baseline to Final Post-test for Interest Questions for the Experimental Group (n=22)

	Baseline	Final Posttest	% Point

	SA/A	SA/A	Change
1. I would rate my oral health as excellent	**45.4**	**68.1**	**22.7**
4. I brush my teeth at least twice a day	**45.4**	**72.7**	**27.3**
5. I floss at least once a day	**18.2**	**72.7**	**54.5**
6. I understand why I have to clean my teeth	72.7	77.2	4.5
12. I actively seek care from a dentist on a routine basis	**31.8**	**54.5**	**22.7**
13. I am interested in having good oral hygiene habits	59.0	54.5	4.5
14. I am interested in knowing how to keep my teeth healthy	59.0	59.0	0.0
16. I am interested in seeking dental care	**31.8**	**36.6**	**4.8**
18. I am interested in my oral health	**40.9**	**63.6**	**22.7**
21. I floss my teeth at least 2-3 times per week	**27.2**	**63.6**	**36.4**
22. I perceive my oral health to be good	**9.1**	**18.2**	**9.1**

Hypothesis Two. The second hypothesis predicted a statistically significant increase in adults' oral health values at baseline and at four weeks after baseline as measured by the *OHQ*. Responses to the Likert scale for each item were summed and averaged. A Wald-Chi Squared test was applied to the average score for questions 3, 7, 8, 9, 17 and 20. Analysis revealed a statistically significant increase in participants' oral health values regardless of group status for items 7 and 20 (see Table 7 and Figure 4). There was a statistically significant group difference for item 9, with 9% more adults in the experimental group reporting that their oral health was important to them than those in the control group. Key questions related to oral health values with the greatest amount of change from the *strongly disagree/disagree/neutral* to the *strongly agree/agree* categories follow:

- item 7, *I feel that good oral hygiene is important.*
- item 9, *My oral hygiene is important to me.*
- item 20, *I follow the directions of my dental professional.*

Table 7. Significant Pretest to Post-test Within Group Differences and Between Group Differences on Oral Health Values Items 7, 9 and 20 of the *Oral Health Questionnaire.*

Item	Effect	DF	WaldChiSq	ProbChiSq (P-value)
7	Time	1	5.6333	0.0176
9	Group	1	4.8315	0.0279
20	Time	1	4.173	0.0411

Based on item 7, there was a statistically significant increase in adults' value of the importance of good oral hygiene over time (X^2 =5.6, df=1, p=0.02), regardless of group status. When comparing the baseline and posttest *strongly agree/agree* responses, the control group increased by 17.8 percentage points from baseline (64.3%) to the final posttest (82.1%) simply by participating in the study; the experimental group increased by 27.3 percentage points indicating that after whitening, participants also placed a higher value on good oral hygiene than the control group.

Item 9, *my oral hygiene is important to me,* revealed a statistically significant difference in adults' value of oral hygiene between groups (X^2 =4.8, df=1, p=0.03), with the experimental group placing a greater importance on oral hygiene as a result of their whitening experience. Both groups reported a statistically significant change overtime for item 20, *I follow the directions of my dental professional* (X^2 =4.1, df=1, p=0.01). The control group had a 13.6 percentage point increase from baseline (35.7%) to the final post-test (53.6%) in the *strongly agree/agree* category; the experimental group also increased by 13.6 percentage points from baseline (45.4%) to final post-test (31.8%)

indicating that people in both groups are likely to follow dental professionals' instructions as a result of participating in the study.

Table 8-A. Percentage Responses for the Pretest Value Questions for the Control Group (n= 28)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	85.7	14.3	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**64.3**	**32.1**	**0.00**	**0.00**	**3.6**
8. I value other's opinion of my teeth	39.2	46.4	10.7	3.6	0.00
9. My oral hygiene is important to me	**82.1**	**17.9**	**0.00**	**0.00**	**0.00**
17. I am conscious of how my teeth look	53.6	39.2	3.6	0.00	0.00
20. I follow the directions of my dental professional	**35.7**	**53.6**	**7.1**	**0.00**	**0.00**

Table 8-B. Percentage Responses for First the Post-test Value Questions for the Control Group (n=28)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	85.7	14.3	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**60.7**	**39.2**	**0.00**	**0.00**	**0.00**
8. I value other's opinion of my teeth	46.4	39.2	10.7	3.6	0.00
9. My oral hygiene is important to me	**85.7**	**14.3**	**0.00**	**0.00**	**0.00**
17. I am conscious of how my teeth look	50.0	39.2	7.14	0.00	0.00
20. I follow the directions of my dental professional	**50.0**	**46.4**	**0.00**	**3.6**	**0.00**

Table 8-C. Percentage Responses for the Final Post-test Value Questions for the Control Group (n=28)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	82.1	17.9	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**82.1**	**14.3**	**0.00**	**3.6**	**0.00**
8. I value other's opinion of my teeth	50.0	35.7	7.1	3.6	3.6
9. My oral hygiene is important to me	**78.6**	**21.4**	**0.00**	**0.00**	**0.00**
17. I am conscious of how my teeth look	57.1	32.1	7.1	0.00	0.00
20. I follow the directions of my dental professional	**53.6**	**35.7**	**3.6**	**3.6**	**0.00**

Table 8-D. Percentage Point Change from Baseline to Final Post-test for Value Questions for the Control Group (n=28)

	Baseline SA/A	Final Posttest SA/A	% Point Change
3. I feel that good oral hygiene is important	**85.7**	**82.1**	**3.6**
7. I place a high value on the health of my teeth and gums	**64.3**	**82.1**	**17.8**
8. I value other's opinion of my teeth	39.2	50.0	10.8
9. My oral hygiene is important to me	**82.1**	**78.6**	**3.5**
17. I am conscious of how my teeth look	53.6	57.1	**3.5**
20. I follow the directions of my dental professional	**35.7**	**53.6**	**17.9**

Table 9-A. Percentage Responses to the Pretest Value Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	86.3	9.1	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**45.4**	**50.0**	**0.00**	**4.5**	**0.00**
8. I value other's opinion of my teeth	18.2	68.1	9.1	4.5	0.00
9. My oral hygiene is important to me	**59.0**	**36.3**	**4.5**	**0.00**	**0.00**

17. I am conscious of how my teeth look	31.8	50.0	9.1	4.5	0.00
20. I follow the directions of my dental professional	**31.8**	**36.3**	**22.7**	**9.1**	**0.00**

Table 9-B. Percentage Responses to the First Post-test Value Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	68.1	31.8	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**86.3**	**13.6**	**0.00**	**0.00**	**0.00**
8. I value other's opinion of my teeth	36.3	50.0	13.6	0.00	0.00
9. My oral hygiene is important to me	**68.1**	**31.8**	**0.00**	**0.00**	**0.00**
17. I am conscious of how my teeth look	40.9	45.4	4.5	9.1	0.00
20. I follow the directions of my dental professional	**45.4**	**40.9**	**9.1**	**4.5**	**0.00**

Table 9-C. Percentage Responses to the Final Post-test Value Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
3. I feel that good oral hygiene is important	81.8	18.2	0.00	0.00	0.00
7. I place a high value on the health of my teeth and gums	**72.7**	**27.2**	**0.00**	**0.00**	**0.00**
8. I value other's opinion of my teeth	40.9	54.5	4.5	0.00	0.00
9. My oral hygiene is important to me	**72.7**	**27.2**	**0.00**	**0.00**	**0.00**
17. I am conscious of how my teeth look	50.0	31.8	9.1	9.1	0.00
20. I follow the directions of my dental professional	**45.4**	**45.4**	**4.5**	**0.00**	**0.00**

Table 9-D. Percentage Point Change from Baseline to Final Post-test for Value Questions for the Experimental Group (n=22)

	Baseline SA/A	Final Posttest SA/A	% Point Change
3. I feel that good oral hygiene is important	86.3	81.8	-4.5
7. I place a high value on the health of my teeth and gums	**45.5**	**72.7**	**27.2**
8. I value other's opinion of my teeth	18.2	40.9	22.7
9. My oral hygiene is important to me	**50.9**	**72.7**	**21.8**
17. I am conscious of how my teeth look	31.8	50.0	18.2
20. I follow the directions of my dental professional	**31.8**	**45.4**	**13.6**

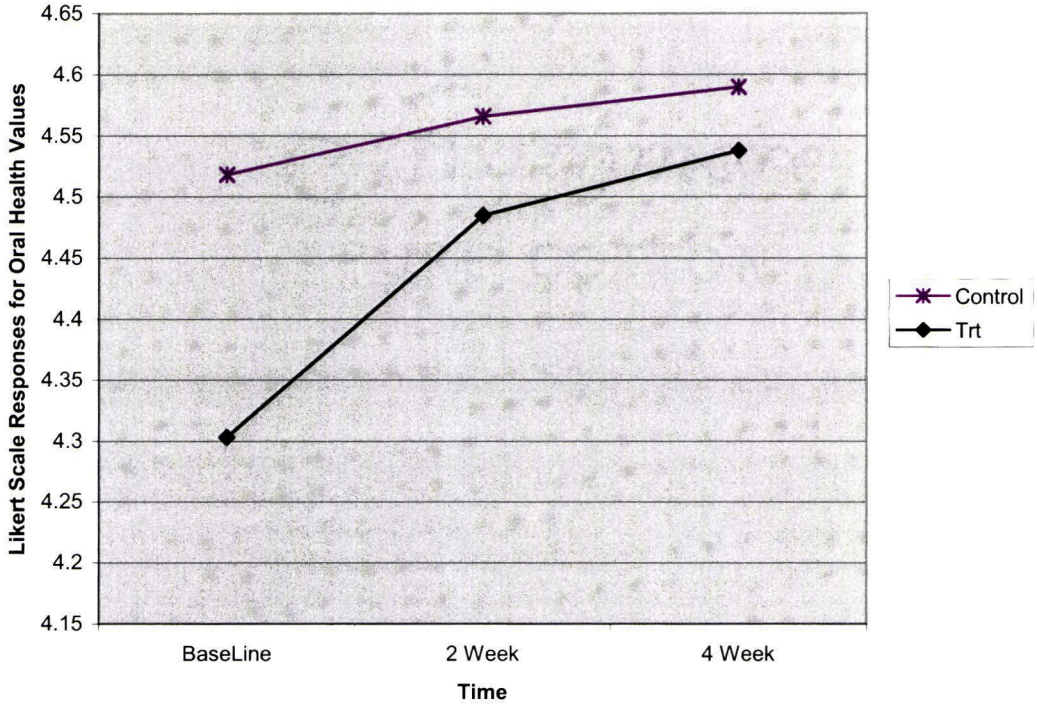

Figure 4. Between and Within Group Differences in Mean Oral Health Value Scores of the Whitening and Non-Whitening Groups Overtime

Hypothesis Three. Hypothesis three predicted a statistically significant relationship between adults' tooth color and the value they place on their oral health. A Wald-Chi Squared test was applied to items 2, 10, 11, 15 and 19. Analysis revealed a statistically significant pretest to post-test improvement in happiness with how their teeth looked for the experimental group. Key questions related to color with the greatest amount of change from the *strongly disagree/disagree/neutral* to the *strongly agree/agree* categories follow:

- item 2, *I am happy with how my teeth look.*
- item 10, *I would change the appearance of my teeth if I could.*

- item 19, *I am satisfied with the appearance of my teeth.*

Table 10. Significant Pretest to Post-test Within Group Differences and Between Group Differences on Items 2, 10 and 19 of the *Oral Health Questionnaire.*

Item	Effect	DF	WaldChiSq	ProbChiSq (P-value)
2	Time	1	11.1005	0.0009
10	Group	1	5.0319	0.0249
10	Time	1	15.1117	0.0001
19	Group	1	11.6571	0.0006
19	Time	1	10.4047	0.0013

Unlike the other hypotheses, the experimental group and control group did not increase in oral health values at the same rate. Only the experimental group had a significant change in their oral health values after tooth whitening. As tooth color lightened, oral health values increased. This outcome can be further validated in item 2, *I am happy with how my teeth look,* which significantly increased over time for the experimental group (X^2=11.1, df=1, p=0.00). The control group, revealed a small percentage point increase from baseline (0.00%) to the final post-test (10.7%), the experimental group, increased by 40.9 percentage points from baseline (4.5%) to the final post-test (45.4%) indicating that those who whitened their teeth were more pleased with

how their teeth looked compared to the control group.

Item 10, *I would change the appearance of my teeth if I could*, increased significantly over time (X^2=5.03, df=1, p=0.02) and between both groups (X^2=11.6, df=1, p=0.00). In the control group, this perspective actually decreased from 78.6% at baseline to 57.1% at final post-test indicating a desire to change the appearance of their teeth. In the experimental group, a 54.5% change occurred from baseline (86.3%) to the final post-test (31.8%) indicating that the participants would not change their tooth color if they could, i.e., they were satisfied with their smiles after using the whitening treatment. Similarly in item 19, there was a significant change overtime (X^2=10.4, df=1, p=0.00) for both groups and a statistically significant post-test difference between the groups (X^2=11.6, df=1, p=0.00) indicating that the whitening group participants were more satisfied with the appearance of their teeth after using the whitening regimen. The control group had a 10.7 percentage point increase from baseline (3.6%) to the final post-test (14.3%) whereas the experimental group had a 36.3 percentage point increase from baseline (0.00%) to the final post-test (36.3%), suggesting that the adults who experienced tooth whitening were more satisfied with the appearance of their teeth at the end of the study. Although not significant, item 11 results showed a greater improvement in the experimental group with a 49.9 percentage point increase compared to the 10.7 percentage point increase in the control group from pretest to post-test, indicating that participants who whitened their teeth were more pleased with their appearance.

Table 11-A. Percentage Responses for the Pretest Tooth Color Satisfaction Questions for the Control Group (n=28)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**0.00**	**25.0**	**17.9**	**46.4**	**10.7**
10. I would change the appearance of my teeth if I could	**78.6**	**21.4**	**0.00**	**0.00**	**0.00**
11. I am pleased with the color of my teeth	**0.00**	**14.3**	**10.7**	**39.2**	**32.1**
15. I am interested in knowing how to keep my teeth white	82.1	17.9	0.00	0.00	0.00
19. I am satisfied with the appearance of my teeth	**3.6**	**28.5**	**14.3**	**35.7**	**17.9**

Table 11-B. Percentage Responses for the First Post-test Color Questions for the Control Group (n=28)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**7.1**	**25.0**	**25.0**	**35.7**	**3.6**
10. I would change the appearance of my teeth if I could	**53.6**	**42.8**	**0.00**	**3.6**	**0.00**
11. I am pleased with the color of my teeth	**3.6**	**14.3**	**7.1**	**64.3**	**10.7**
15. I am interested in knowing how to keep my teeth white	75.0	25.0	0.00	0.00	0.00
19. I am satisfied with the appearance of my teeth	**3.6**	**21.4**	**21.4**	**46.4**	**7.14**

Table 11-C. Percentage Responses for the Final Post-test Color Questions for the Control Group (n=28)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**10.7**	**21.4**	**17.9**	**39.2**	**10.7**
10. I would change the appearance of my teeth if I could	**57.1**	**39.2**	**0.00**	**3.6**	**0.00**
11. I am pleased with the color of my teeth	**10.7**	**17.9**	**7.1**	**46.4**	**17.9**
15. I am interested in knowing how to keep my teeth white	85.7	14.3	0.00	0.00	0.00
19. I am satisfied with the appearance of my teeth	**14.3**	**21.4**	**14.3**	**32.1**	**17.9**

Table 11-D. Percentage Point Change from Baseline to Final Post-test for Color Questions for the Control Group (n=28)

	Baseline SA/A	Final Posttest SA/A	% Point Change
2. I am happy with how my teeth look	**0.00**	**10.7**	**10.7**
10. I would change the appearance of my teeth if I could	**78.6**	**57.1**	**-21.5**
11. I am pleased with the color of my teeth	**0.00**	**10.7**	**10.7**
15. I am interested in knowing how to keep my teeth white	**82.1**	**85.7**	**3.6**
19. I am satisfied with the appearance of my teeth	**3.6**	**14.3**	**10.7**

Table 12-A. Percentage Responses to the Pretest Tooth Color Satisfaction Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**4.5**	**27.2**	**22.7**	**36.3**	**9.1**
10. I would change the appearance of my teeth if I could	**86.3**	**13.6**	**0.00**	**0.00**	**0.00**
11. I am pleased with the color of my teeth	**0.00**	**4.5**	**18.2**	**59.0**	**18.2**
15. I am interested in knowing how to keep my teeth white	72.7	22.7	27.2	0.00	0.00
19. I am satisfied with the appearance of my teeth	**0.00**	**22.7**	**18.2**	**45.4**	**13.6**

Table 12-B. Percentage Responses to the First Post-test Color Questions for the

Experimental Group (n=22)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**36.3**	**40.9**	**4.5**	**18.2**	**0.00**
10. I would change the appearance of my teeth if I could	**36.3**	**40.9**	**9.1**	**13.6**	**0.00**
11. I am pleased with the color of my teeth	**36.3**	**27.2**	**9.1**	**22.7**	**4.5**
15. I am interested in knowing how to keep my teeth white	36.3	36.3	13.6	4.5	4.5
19. I am satisfied with the appearance of my teeth	**31.8**	**31.8**	**9.1**	**27.2**	**0.00**

Table 12-C. Percentage Responses to the Final Post-test Color Questions for the Experimental Group (n=22)

	SA	A	N	D	SD
2. I am happy with how my teeth look	**45.4**	**40.9**	**4.5**	**9.1**	**0.00**
10. I would change the appearance of my teeth if I could	**31.8**	**36.3**	**18.2**	**13.6**	**0.00**
11. I am pleased with the color of my teeth	**36.3**	**45.4**	**9.1**	**9.1**	**0.00**
15. I am interested in knowing how to keep my teeth white	72.7	27.2	0.00	0.00	0.00
19. I am satisfied with the appearance of my teeth	**36.3**	**45.4**	**4.5**	**13.6**	**0.00**

Table 12-D. Percentage Point Change from Baseline to Final Post-test for Color Questions for the Experimental Group (n=22)

	Baseline SA/A	Final Posttest SA/A	% Point Change
2. I am happy with how my teeth look	**4.5**	**45.4**	**40.9**
10. I would change the appearance of my teeth if I could	**86.3**	**31.8**	**-54.5**
11. I am pleased with the color of my teeth	**4.5**	**45.4**	**49.9**
15. I am interested in knowing how to keep my teeth white	**22.7**	**27.2**	**4.5**
19. I am satisfied with the appearance of my teeth	**0.00**	**36.3**	**36.3**

Although unhypothesized, it should be noted that both groups had no significant differences in tooth color at baseline; however, as expected, the participants who used the three-week whitening regimen had significantly whiter teeth at both the two and four-week post-test periods (see Figure 5).

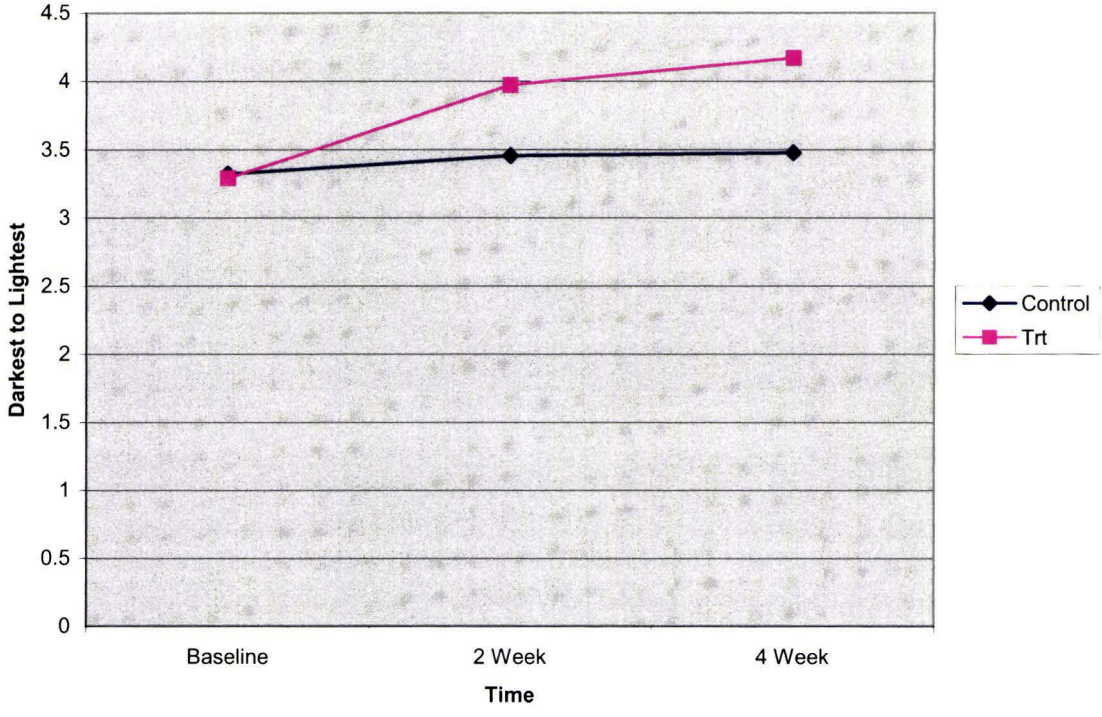

Figure 5. Comparison of Experimental and Control Groups' Assessed Tooth Color Change Over time

Discussion

There have been studies published on the effectiveness and safety of over-the-counter and in-office tooth whitening products (Gerlach et al. 2000, Sagel & Landrigan, 2004). However, few studies have focused on persons' oral health values, quality of life, and self image related to tooth whitening (Odioso et al. 2000). None have primarily compared tooth color to oral health interest and values. This present study was conducted to determine if tooth color change influences oral health interests and values in adults.

Hypothesis One. Adults' in both groups experienced greater interest in their oral health from baseline to post-tests just from participation in the study. While greater interest in oral health was expected for the group which received the whitening regimen, it was an unanticipated result for the control group. One explanation for this finding is the Hawthorne effect, whereas, subjects may have responded favorably or reported more positive oral health interests and behaviors simply because they were being observed and measured (Berg & Latin, 2004). When individuals know they are being monitored, they may want to please the researchers and provide the most socially-acceptable response rather than express their true interests (Berg & Latin, 2004). Another explanation may be that the study attracted people who were already interested in their oral health and participation in the study only augmented their oral health interests. Given this interpretation of the results, it would be advantageous to alter the research design to a true double blind design in order to decrease the Hawthorne effect, minimize subject selection bias, and strengthen the validity of the research outcomes. The fact that both groups reported greater interest in their oral health might also be related to the homecare instructions that both groups received from the research assistant who was a registered

dental hygienist. This interpretation is supported by Griffiths (2002) who found that 98% of people in his study felt that they benefited in some way from seeing their dental hygienist, and 99% felt that they had used or acted upon the oral hygiene instructions recommended by their hygienist. Perhaps all participants were similarly influenced by the self-care instructions from registered dental hygienists during the study. Dental hygienists probably influenced the oral health interests and behaviors of the individuals.

In the present study, participants were asked to brush twice daily for two minutes and floss once a day. This request could have simulated more oral self care in the participants, resulting in cleaner mouths and whiter teeth for everyone in the study. Brushing and flossing could have also sensitized subjects to the proper oral care regimen recommended by most oral professionals and again increased their interest in oral health overall. With improved oral health care habits, participants may have become more conscience of their own smile, and interested in maintaining these new oral self-care behaviors. This increased interest in oral health and oral health behaviors in turn might positively effect peoples' attitudes towards their own appearance and smile. These findings and interpretations support those of Ostberg et al. (2001) who believed that having a whiter smile can facilitate better oral health care behaviors. Continued research is necessary before a definite conclusion about whether tooth whitening can raise ones' interest in oral health.

Hypothesis Two. Hypothesis two predicted that the three-week tooth whitening regimen would increase oral health values in adults. Results revealed that oral health values increased in both the experimental and control groups with the whitening regimen yielding no superior effect. One plausible rival hypothesis might be the pre-test effect.

Because all participants experienced the *OHQ,* perhaps they were sensitized to the contents, remembered previous answers, and elected to choose what they perceived to be the most socially-acceptable response (Berg & Latin, 2004). Regardless of group status, people were attracted to the whitening product and appeared to be motivated to seek dental care as found by Blankenau et al. (1999). Just responding to the content of the *OHQ,* knowing that their teeth were going to be assessed, and receiving oral health products and instructions, may have stimulated their interest in their oral health. For example, knowing that they were going to be evaluated by an oral professional also could have influenced how they were brushing and flossing, and stimulated their interest in oral health over the time of the study. Otherwise known as hypothesis-guessing, this threat to reliability might have had the participants guessing how the experimenter expected them to behave or change (Cooper & Hedges, 1994). These findings and interpretations are supported by Griffiths (2002) who stated that adults' perception of their oral health and compliance to professional oral instructions increased with more regular dental hygiene visits. In contrast, the findings conflict with those of Bradnock (2001) who found that adults do not feel visiting the dentist would improve the appearance of their teeth. More research is necessary before a definite conclusion can be reached about whether tooth whitening increases ones' oral health values.

Hypothesis Three. Hypothesis three predicted a statistically significant relationship between adults' tooth color and the value they place on their oral health. This is the only hypothesis where change occurred in the experimental group at a different rate than the control group, leading the researchers to believe that as tooth color increased in whiteness, oral health values and interests also increased. Because both groups had an

increase in oral health value, this increase may lead the participants to become more conscience of their own oral health and seek routine dental care. Perhaps this finding demonstrates that if one has whiter teeth, one might place a higher value on their oral health. These results are clinically relevant to dental professionals interested in using tooth whitening to promote oral health interests and values in their clients. This finding is supported by the work of Gerlach (2002) who believes that whitening improves oral hygiene and patient interest in dentistry.

Bradnock et al. (2001) found that only 23% of adults go to the dentist on a regular basis, whereas this present research found that 66% of adults had some type of dental appointment within the last year. The difference could be cultural in that Bradnock's target population resided in Great Britain. It was found in this present study that only 4.5% of participants do not actively seek oral health care from a dentist on a routine basis. So this sample might have had a higher dental IQ than the average adult (see Table 6A). More research is necessary before a definite relationship among tooth color, oral health values and oral health interest can be established.

CHAPTER V

SUMMARY AND CONCLUSIONS

Vital tooth whitening has become very popular to the public as well as a lucrative, noninvasive service provided by dentists and dental hygienists. There are numerous types of whitening products available to consumers both in-office and over-the-counter. The introduction of Crest Whitestrips® has increased the popularity and ease of at-home tooth whitening making whiter teeth available to the majority. There have been many studies on the effectiveness and safety of both at-home and over-the-counter whitening products. There have been fewer studies regarding personal values about oral health and perceptions of esthetically pleasing smiles from tooth whitening. A whiter, straighter smile is thought to be most esthetically pleasing regardless of demographic characteristics (Dunn et al. 1996). Little research has been established comparing vital tooth whitening and the effect it may have on one's oral health values and interests.

The primary purposes of this study were to determine if using a vital tooth whitening product would influence adults' oral health interest and values and to determine if vital tooth whitening changes one's perceptions of their oral health. Currently, there is no research regarding vital tooth whitening and its role in assisting dental hygienists with patient motivation toward improved oral health interests, oral health values and patient oral homecare compliance.

Fifty participants who completed the study were randomized into two groups: whitening group (n=22) and control group (n=28). Within the framework of a pretest, multiple post-test design, both groups were asked to complete the *OHQ*. The whitening group was asked to start the Crest Whitestrips® according to the manufacturer's

directions and follow specific oral homecare instructions, while the control group was asked only to follow the oral homecare instructions. Both groups returned in two-weeks and then again in four-weeks following baseline to complete the questionnaire and to have their tooth color measured. At each visit, participants were assessed for side and adverse effects from the whitening regimen. Data were then analyzed by using percentages and a Wald-Chi Squared test. Results revealed that both groups experienced an increase in their oral health interests and oral health values over the course of the study. Interestingly, even though the control group was not exposed to the whitening intervention during the clinical trial, they also had an increase in their oral health interests and values. This outcome was not expected and is attributed to the Hawthorne effect, oral health instructions from the research assistant, and subject selection bias which can affect the study's internal validity. The results also revealed a significant difference between the experimental and control groups when asked if their tooth color affected the value they placed on their oral health. The experimental group had an increase in the value they placed on their oral health after using the whitening regimen, while the control group had no significant change in values. This finding suggests a link between whiter teeth and the value one places on oral health.

Based on the results, the following conclusions are made:

1. Tooth color affects the value adults place on their oral health. This in turn might lead to an increase in oral health and more frequent dental visits.
2. Vital tooth whitening can increase adults' oral health values.
3. Specific oral hygiene instructions/recommendations from dental hygienist can increase the value one places on oral health, even without tooth whitening.

4. Vital tooth whitening can increase adults' interest in their oral health. Having a whiter smile can augment one's interest in maintaining this attractive smile and as such, focus on oral health and improve oral self-care behaviors simultaneously.

Based on the fact that this study only included 50 participants ranging from 18-60 years of age located in southeastern Virginia, the following recommendations for future research are indicated:

1. Replicating this study with a larger, more diverse sample size.
2. Replicating this study with older and younger age ranges.
3. Replicating this study using gender as a factor.
4. Replicating this study using participants who have used a whitening agent.
5. Replicating this study with a longer time frame since values and interests may take longer to change.
6. Determining if daily oral hygiene habits are linked to participants' oral health interests and values.
7. Determining if client oral hygiene behaviors and oral health interests and values change as a result of instructions given by a registered dental hygienist.

Based on the results of this study, over-the-counter Crest Whitestrips® Supreme can lighten tooth color as well as increase adults' interest in oral health. Hygienists can use whitening products to promote and encourage good oral hygiene habits. More research needs to be conducted to endorse vital tooth whitening as a motivational strategy in dental hygiene practice.

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Appendix A

INFORMED CONSENT DOCUMENT
OLD DOMINION UNIVERSITY

PROJECT TITLE: Effects of Over-the Counter Tooth Whitening Use on Oral Health Interests and Values of Adults

INTRODUCTION

The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this research, and to record the consent of those who say YES. This research, "Effects of Over-the-Counter Tooth Whitening Use on Oral Health Interests and Values of Adults" will be conducted in the Dental Hygiene Research Center, 1st floor of Technology Building on the campus of Old Dominion University.

RESEARCHERS

The researchers involved in this study are:

Michele Darby, BSDH, MS
University Professor and Eminent Scholar
College of Health Sciences
School of Dental Hygiene
Katie Jo Ballantyne, BSDH
Gayle McCombs, BSDH, MS
Sharon Stull, BSDH, MS

DESCRIPTION OF RESEARCH STUDY

Several studies have been conducted looking into the subject of tooth whitening products; however, none have ever explained the effects that tooth whitening has on how people feel about their personal oral health

If you decide to participate, then you will join a study involving research of your tooth color and your feelings about your oral health as measured by the *Oral Health Questionnaire* that you will first take during the initial visit. If you say YES, then your participation will last for four weeks and require three visits to the Dental Hygiene Research Center including the first prescreening visit. Depending upon the group you are assigned to, you may or may not be instructed to use a two-week long whitening strip regimen according to manufacturer's directions. Following the two weeks, you will then have your tooth color measured again, have a brief oral exam, and re-take the *Oral Health Questionnaire.* At a final appointment four weeks after the start of the study, you will have an appointment to re-take the *Oral Health Questionnaire,* have your tooth color measured again and have a final brief oral exam. Approximately 60 adults will be participating in this study. There is an equal chance of you receiving the white strips to use for two weeks or not receiving a whitening product during the study. After all data have been collected, participants who did not use the white strips during the study will receive the product for use after completing the study.

EXCLUSIONARY CRITERIA

You should have completed the preliminary screening questionnaire with the research assistant. To the best of your knowledge, you should have at least eight front teeth, not have used any type of tooth whitening product, not have any type of cosmetic teeth or tooth colored fillings in the front teeth of your mouth, not be pregnant, or breast feeding an infant, not use tobacco products of any kind that would keep you from participating in this study.

RISKS AND BENEFITS

RISKS: If you decide to participate in this study, then you may face a risk of gum irritation and or tooth sensitivity. These risks are no more than what you may experience when purchasing and using an over-the-counter whitening strip product. The researcher tried to reduce these risks by performing an oral exam on you during the prescreening phase of the study to determine if you currently have any gum irritation or tooth sensitivity. And, as with any research, there is some possibility that you may be subject to risks that have not yet been identified.

BENEFITS: The main benefit to you for participating in this study is you will be provided with a toothbrush, non-whitening toothpaste, floss, and written and oral hygiene instructions. The experimental group will also receive a two- week supply of tooth whitening product strips. If you find yourself assigned to the control group of the study, at the completion of the data collection you will also receive a two week supply of tooth whitening strips for home use.

COSTS AND PAYMENTS

The researchers are unable to give you any payment for participating in this study.

NEW INFORMATION

If the researchers find new information during this study that would reasonably change your decision about participating, then they will give it to you.

The researchers will take steps to ensure that your private information, such as screening form, medical history, anc questionnaire are kept confidential. The researcher will assign you a number code and only the researcher will know thal number throughout the study. All information regarding participants in the study will be kept in a locked file cabinet in which only the researcher has access. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify you. Of course, your records may be subpoenaed by court order or inspected by government bodies with oversight authority.

WITHDRAWAL PRIVILEGE

It is OK for you to say NO. Even if you say YES now, you are free to say NO later, and walk away or withdraw from the study – at any time. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled. The researchers reserve the right to withdraw your participation in this study at any time, if they observe potential problems with your continued participation.

COMPENSATION FOR ILLNESS AND INJURY

If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of harm, injury, or illness arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in any research project, you may contact Michele Darby at (757) 683-5232 or Dr. David Swain the current IRB chair at 757-683-6028 at Old Dominion University, who will be glad to review the matter with you.

VOLUNTARY CONSENT

By signing this form, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Michele Darby:	683– 5232
Katie Ballantyne:	683- 4719
Gayle McCombs	683- 5150
Sharon Stull	683 – 5230

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. David Swain, the current IRB chair, at 757-683-6028, or the Old Dominion University Office of Research, at 757-683-3460.

And importantly, by signing below, you are telling the researcher YES, that you agree to participate in this study. The researcher should give you a copy of this form for your records.

Subject's Printed Name & Signature	**Date**

INVESTIGATOR'S STATEMENT

I certify that I have explained to this subject the nature and purpose of this research, including benefits, risks, costs, and any experimental procedures. I have described the rights and protections afforded to human subjects and have done nothing to pressure, coerce, or falsely entice this subject into participating. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the subject's questions and have encouraged him/her to ask additional questions at any time during the course of this study. I have witnessed the above signature(s) on this consent form.

Investigator's Printed Name & Signature	**Date**

Appendix B

Oral Health Questionnaire

#_____

Directions: This questionnaire seeks your opinion regarding your oral health. Your opinions are important, and your identity is not required. Please respond to each item truthfully and to the best of your knowledge. THANK YOU!

Part I. Demographics. Please answer each question by checking the box (x) that reflects the one choice that BEST describes you.

1. Please indicate your gender:

   - ❑ Female
   - ❑ Male

2. Please indicate your age at the time of your last birthday:

   - ❑ 18-29
   - ❑ 30-39
   - ❑ 40-49
   - ❑ 50-60

3. Please indicate your race:

   - ❑ Caucasian
   - ❑ Hispanic
   - ❑ American Indian or Alaskan Native
   - ❑ Black
   - ❑ Asian or Pacific Islander

- ❑ Other_____(specify)

4. What is your marital status?

- ❑ Married
- ❑ Single
- ❑ Divorced/Separated
- ❑ Widow(er)

5. What is your annual income?

Less than 10,000	30,000-39,999	60,000 or more
10,000-19,999	40,000-49,999	unemployed
20,000-29,999	50,000-59,999	

6. Have you seen a dentist for a regular check-up within the past year?

- ❑ Yes
- ❑ No

7. How often do you seek care from a dentist?

- ❑ When I have a dental problem
- ❑ About once each year
- ❑ Every six months
- ❑ About every few years
- ❑ I have never been to a dentist

Part II. Attitudes Read each statement and determine how you feel about it, i.e., whether you *strongly agree*, *agree*, *no opinion*, *disagree*, *strongly disagree*. Please circle the letters that correspond to these meanings:

SA=*strongly agree*, A=*agree*, N=*no opinion*, D=*disagree*, SD=*strongly disagree*

---

1. I would rate my oral health as excellent	SA	A	N	D	SD
2. I am happy with how my teeth look	SA	A	N	D	SD
3. I feel that good oral hygiene is important	SA	A	N	D	SD
4. I brush my teeth at least twice a day	SA	A	N	D	SD
5. I floss at least once a day	SA	A	N	D	SD
6. I understand why I have to clean my teeth	SA	A	N	D	SD
7. I place a high value on the health of my teeth and gums	SA	A	N	D	SD
8. I value other's opinion of my teeth	SA	A	N	D	SD
9. My oral hygiene is important to me	SA	A	N	D	SD
10. I would change the appearance of my teeth if I could	SA	A	N	D	SD
11. I am pleased with the color of my teeth	SA	A	N	D	SD
12. I actively seek care from a dentist on a regular basis	SA	A	N	D	SD
13. I am interested in having good oral hygiene habits	SA	A	N	D	SD
14. I am interested in knowing how to keep my teeth healthy	SA	A	N	D	SD
15. I am interested in knowing how to keep my teeth white	SA	A	N	D	SD

16. I am interested in seeking dental care SA A N D SD

17. I am conscious of how my teeth look SA A N D SD

18. I am interested in my oral health SA A N D SD

19. I am satisfied with the appearance of my teeth SA A N D SD

20. I follow the directions of my dental professional SA A N D SD

21. I floss my teeth at least 2-3 times per week SA A N D SD

22. I perceive my oral health to be good SA A N D SD

To be added to the post-study questionnaire:

23. Did you experience any problems since the beginning of this study?

- ❑ Yes, specify_____
- ❑ No

Thank You,

Please return your questionnaire to the research assistant

Appendix C

Standardized Experimental Group

Subject Instructions

Have you been screened?	Yes	No
Have you signed the consent form?	Yes	No
Did you fill out the *Oral Health Questionnaire*?	Yes	No

To begin, an initial shade reading will be taken of your front teeth. (tooth shade measurement)

Now, I will ask you to follow the specific instructions provided here anytime you use the white strips.

- Do not brush right before using the strips.
- Dry your teeth using a cloth or gauze before you place the strips
- Find the zigzag slit at the end of the strip to remove it from the liner.
- Place the gel side towards the teeth and against the gum line.
- Press firmly beginning at your front teeth and working towards the back teeth.
- Fold the rest of the strip behind the teeth.
- Repeat for bottom teeth.
- Keep strips on for 30 minutes.

- Remove strips and rinse with water.
- Do not eat or drink while wearing the strips.
- Do not wear the strips over night.
- Please use only the toothpaste and brush that is provided to you by the researchers.
- Brush twice a day for 2 minutes at each brushing session.
- Do not use a power toothbrush during the next two weeks while you are in the study.
- Do not use any kind of mouth rinses or oral products with whitening products or chemicals in the ingredients.
- Do not miss a day of using the strips, as this will interfere with the results of the study.
- DO NOT tell or discuss with the research assistant/examiner if you are using the white strips or if you are not using the white strips. This would compromise the results of the study.

If you have any questions regarding directions, please feel free to contact Katie Ballantyne at 683-4719.

Standardized Control Group

Subject Instructions

Have you been screened? Yes No

Have you signed the consent form? Yes No

Did you fill out the *Oral Health Questionnaire*? Yes No

To begin, an initial shade reading will be taken of your front teeth. (tooth color measurement)

Now, I will ask you to follow the specific instructions provided here.

- Please use only the toothpaste and brush that is provided to you by the researchers.
- Brush twice a day for 2 minutes at each brushing session.
- Do not use a power toothbrush during the next two weeks while you are in the study.
- Do not use any kind of mouth rinses or oral products with whitening products or chemicals in the ingredients.
- DO NOT tell or discuss with the research assistant/examiner if you are using the white strips or if you are not using the white strips. This would compromise the results of the study.

If you have any questions regarding directions, please feel free to contact Katie Ballantyne at 683-4719.

Appendix D

Screening Form to Determine Inclusion/Exclusion Criteria

Participant Information

Assigned Number _____

Date of Birth _____

Exclusion Criteria:

- Do you have any white fillings, crowns, or veneers on your front teeth?

  YES NO

- Have you ever had a root canal on any of your front teeth?

  YES NO

- Do you smoke or chew tobacco, even on occasion?

  YES NO

- Have you ever used or tried any type of tooth bleaching or whitening product, either over-the-counter or from your dentist?

  YES NO

- Are you pregnant, nursing (breast feeding) a baby or trying to get pregnant?

  YES NO

- Are you younger than 18 or older than 60 years of age?

  YES NO

- Do you feel there is anything; including medical problems that may you keep you from participating in this study? If yes, please explain._____

Inclusion Criteria:

- Is at or between the ages of 18 to 60.

  YES NO

- Has at least 8 anterior teeth and no anterior teeth have tooth-colored restorations.

  YES NO

- Is in good health so as not to contraindicate use of the whitening strips.

  YES NO

Meets inclusion criteria and has no exclusion factors.

YES NO

_____

Signature of research assistant or principal investigator Date

Appendix E

Telephone Pre-Screening Questionnaire

Directions: Please use the following questions to telephone screen all possible subjects who are interested in participating in the tooth whitening research.
If they answer "yes" to ANY of the questions, politely explain that they have one or more answers that would exclude them from participation in the study.
Thank them for their interest and invite them to continue to participate in further studies at the Old Dominion Dental Research Center.

1. Do you have any white fillings, crowns, or veneers on your front teeth?

NO YES

2. Do you smoke or chew tobacco, even on occasion?

NO YES

3. Have you ever used or tried any type of tooth bleaching or whitening product, either over-the-counter or from your dentist?

NO YES

4. Would you have difficulty using a prescribed oral hygiene routine, twice daily for two weeks?

NO YES

5. Are you pregnant, nursing (breast feeding) a baby or trying to get pregnant?

YES NO

6. Are you younger than 18 or older than 60 years of age?

YES NO

If the subject answered YES to ANY of the questions, please exclude them from further participation. Thank you.

Appendix F
Subject Recruitment Flyer

(to be posted around campus or emailed to the campus community)

DO YOU WANT WHITER TEETH??

COME PARTICIPATE IN A STUDY AND RECEIVE
FREE
A TOOTH WHITENING PRODUCT!

SIGN UP IN THE DENTAL HYGIENE CARE FACILITY IN THE TECHNOLOGY BUILDING AT OLD DOMINION UNIVERSITY
or call 683-4719

THOSE WHO MEET THE REQUIREMENTS WILL PARTICIPATE IN A STUDY CONDUCTED BY THE OLD DOMINION UNIVERSITY SCHOOL OF DENTAL HYGIENE

Participants will receive:

- ***A free three-week whitening product***
- ***Oral care instructions***
- ***Free toothpaste, toothbrush, and floss***

We are interested to see if whitening your teeth will change how you feel about your oral health.

Sign up NOW!

If you have any questions, please feel free to call:
Katie Ballantyne at 683-4719 or Michele Darby at 683-5232

Appendix G

Adverse Events Form

Study: _____ **Dental Hygiene Research Center**

Protocol # _____ **Old Dominion University**

Subject ID: _____

Adverse Events (AE)

Did any adverse events occur during the clinical trial? Yes, please record below
No

/erse Event	**Start Date** (mm/dd/yyyy)	**Stop Date*** (mm/dd/yyyy)	**Maximum Intensity** 1-Mild 2-Moderate 3-Severe	**Action Taken** 1-None 2-Contact Medical 3-Hospital 4-Other (specify)	**Relationship to Investigational Product** 1-Non-related 2-Remote 3-Possible 4-Probable	**Subject Outcome** 1-Recovered 2-Recovered w/ sequelae 3-AE is still present 4-Died 5-Data not available
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Appendix H
Services Rendered Form

Dental Hygiene Research Center
Old Dominion University

Study: _____
Protocol #: _____
Subject ID: _____

Services Rendered

Date: ___/___/____
Oral Exam Findings: Negative Positive (explain) _____
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_____

Date: ___/___/____
Oral Exam Findings: Negative Positive (explain) _____
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Date: ___/___/____
Oral Exam Findings: Negative Positive (explain) _____
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Date: ___/___/____
Oral Exam Findings: Negative Positive (explain) _____
_____
_____

APPENDIX I
Raw Data

Key:

1-60: participant number
E: experimental group
C: control group
BQ#: baseline questionnaire
P1Q#: post-test one questionnaire
P2Q#: post-test two questionnaire
Shade 1: pre-whitening tooth shade
Shade 2: post-test whitening tooth shade

		BQ1	BQ2	BQ3	BQ4	BQ5	BQ6	BQ7	BQ8	BQ9	BQ10	BQ11	BQ12	BQ13	BQ14	BQ15	BQ16	BQ17	BQ18	BQ19	BQ20	BQ21	BQ22
1	E	A	N	SA	N	D	SA	A	SA	SA	SA	D	A	SA	SA	SA	SA	SA	SA	D	A	D	A
3	E	A	D	SA	SA	SA	SA	A	A	SA	SA	D	A	SA	SA	SA	N	A	N	D	A	SA	A
4	E	A	SD	SA	A	A	SA	SA	SA	SA	SA	SD	SA	SA	SA	SA	SA	SA	SA	SD	SA	SA	D
9	E	A	SA	SA	SA	D	SA	A	A	SA	SA	A	SA	SA	SA	SA	SA	A	A	A	A	A	A
10	E	D	D	A	A	N	SA	A	A	N	SA	D	N	A	A	SA	A	A	SA	A	SA	A	A
14	E	D	D	SA	N	N	SA	SA	A	SA	SA	SD	D	A	A	A	A	A	A	SD	N	A	N
23	E	N	SD	A	A	D	A	A	N	A	SA	D	A	A	A	A	N	N	A	SD	A	A	A
25	E	D	D	SA	SA	A	SA	SA	A	SA	SA	D	A	SA	SA	SA	SA	SA	SA	D	A	SA	A
27	E	SA	A	SA	SA	SA	SA	SA	A	SA	A	D	SA	A	A	SA	A	SA	SA	D	SA	A	A
28	E	A	N	SA	SA	SA	SA	SA	A	SA	A	D	SA	SA	SA	A	D	A	N	A	SA	D	D
29	E	SA	A	SA	SA	N	SA	SA	SA	SA	SA	N	D	SA	A	SA	D	SA	N	N	N	SA	N
35	E	A	A	SA	A	D	SA	SA	SA	SA	SA	D	A	SA	SA	SA	SA	A	A	A	SA	D	SA
37	E	A	D	SA	D	D	A	A	A	A	SA	SD	D	SA	SA	SA	A	SA	SA	D	D	A	A
38	E	N	A	SA	SD	SD	A	A	A	A	SA	N	A	A	A	SA	N	A	A	D	N	SD	A
41	E	SA	D	SA	SA	D	SA	A	A	SA	SA	D	D	A	A	A	A	A	A	D	A	A	N
46	E	D	N	SA	SA	SD	SA	A	N	A	SA	D	N	SA	SA	SA	SA	N	SA	N	N	SD	A
48	E	A	A	SA	SA	A	SA	SA	A	SA	SA	D	SA	SA	SA	SA	A	SA	A	D	A	A	A
49	E	A	D	SA	SA	D	SA	SA	A	SA	SA	D	D	SA	SA	SA	N	A	SA	D	SA	N	SA
50	E	D	N	SA	A	D	A	A	A	A	SA	N	SD	A	A	A	A	A	A	N	N	SD	N
51	E	D	A	SA	D	SD	SD	D	A	A	A	D	A	A	A	A	A	A	D	A	D	D	D
52	E	N	D	A	D	SA	A	A	D	A	SA	SD	D	A	SA	SA	SA	A	A	D	SA	SA	A
58	E	A	N	SA	A	A	SA	SA	A	A	SA	N	N	SA	SA	SA	N	D	SA	N	A	SA	N
2	C	SA	D	SA	SA	SD	SA	SA	N	SA	A	D	SA	SA	SA	A	N	A	N	D	SA	D	A
5	C	A	D	SA	SA	D	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA	D	SA	A	A
6	C	A	N	SA	SA	N	SA	SA	A	SA	SA	D	A	A	A	SA	D	A	N	A	SA	A	A
7	C	D	D	SA	SA	D	A	A	A	A	A	D	A	SA	SA	A	A	A	A	D	A	A	A
8	C	SA	A	SA	A	SA	SA	SA	A	SA	SA	A	SA	SA	SA	SA	SA	SA	SA	A	SA	SA	D
11	C	A	D	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA	N	SA	SA	D
15	C	A	D	SA	D	A	SA	SA	A	SA	SA	D	A	A	A	SA	A	A	A	D	A	A	A
16	C	SD	SD	SA	A	D	A	SD	A	A	SA	D	SD	SA	SA	SA	SA	A	A	D	SD	D	SD
17	C	A	D	SA	A	D	SA	A	SA	SA	SA	SD	SA	SA	SA	SA	SA	SA	SA	D	A	A	A
18	C	N	D	SA	SA	A	SA	A	N	SA	SA	SD	A	SA	SA	SA	A	A	SA	D	A	N	D
19	C	A	N	SA	SA	A	SA	SA	SA	SA	SA	D	A	SA	SA	SA	SA	SA	SA	D	SA	SA	SA
21	C	A	D	SA	SA	A	SA	SA	A	SA	SA	D	A	SA	SA	SA	A	A	A	D	SA	A	D
22	C	A	N	SA	SA	N	A	A	D	SA	A	N	SA	SA	SA	SA	SA	A	A	N	A	SA	N
26	C	N	N	SA	A	N	A	A	A	SA	SA	N	A	SA	SA	SA	SA	A	SA	A	SA	SA	A
30	C	D	SD	SA	SA	D	SA	SA	SA	SA	SA	SD	D	SA	SA	SA	SA	SA	SA	SD	A	D	A
31	C	SA	A	SA	SA	SA	SA	SA	SA	SA	A	A	A	A	A	SA	A	SA	N	SA	A	SA	N
32	C	A	A	A	SA	A	A	A	A	A	SA	A	A	SA	SA	SA	SA	SA	SA	A	A	A	A
33	C	D	SD	SA	A	A	SA	SA	A	SA	SA	SD	D	SA	SA	SA	SA	SA	SA	SD	A	A	D
36	C	D	D	SA	SD	SD	SA	SA	SA	SA	SA	SD	SD	SA	SA	SA	SA	N	SA	N	SA	SD	A
39	C	A	D	SA	D	A	A	A	A	A	SA	SD	SA	SA	SA	SA	SA	SA	SA	SD	A	SA	A
40	C	A	D	SA	SA	N	SA	SA	SA	SA	SA	SD	SA	SA	SA	SA	SA	SA	SA	D	A	A	SA
42	C	A	A	A	A	SD	SA	SA	SA	SA	SA	N	SA	SA	SA	SA	SA	SA	SA	A	SA	SD	A
43	C	A	D	SA	A	A	SA	SA	A	SA	A	D	SA	SA	SA	SA	SA	SA	SA	A	A	A	A
44	C	A	A	SA	D	D	SA	SA	A	SA	SA	A	D	A	A	A	A	A	A	A	A	D	D
55	C	N	N	A	SA	D	A	A	N	A	SA	D	N	A	A	A	N	A	A	N	N	N	A
57	C	D	A	SA	A	A	SA	A	A	SA	A	A	A	A	A	A	N	A	A	A	A	D	A
59	C	D	D	A	A	D	A	SA	SA	SA	SA	SD	D	SA	SA	SA	SA	SA	SA	SD	A	D	A
60	C	A	A	SA	SA	SA	SA	SA	SA	SA	SA	SD	N	SA	SA	SA	SA	SA	A	SD	N	A	N

BQ23	BQ24	P1Q1	P1Q2	P1Q3	P1Q4	P1Q5	P1Q6	P1Q7	P1Q8	P1Q9	P1Q10	P1Q11	P1Q12	P1Q13P	P1Q14	P1Q15	P1Q16	P1Q17	P1(
F	Y	A	A	SA	SA	D	SA	SA	SA	SA	A	N	SA	SA	SA	SA	SA	SA	SA
B	Y	A	SA	A	SA	SA	SA	SA	A	SA	A	SA	A	A	A	SA	SA	A	SA
E	Y	A	SA	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA
F	Y	A	A	A	A	D	SA	SA	A	SA	SA	SA	SA	SA	SA	SA	A	A	A
B	N	N	SA	A	SA	A	A	A	SA	A	D	SA	A	A	A	SA	A	SA	A
C	Y	N	D	SA	A	N	SA	SA	A	SA	SA	SD	SD	A	N	N	N	N	A
D	Y	A	A	A	A	A	SA	SA	A	SA	A	A	A	A	A	A	A	A	A
D	Y	A	N	SA	SA	A	SA	SA	N	SA	SA	N	A	SA	SA	SA	SA	SA	SA
E	Y	A	SA	A	A	A	A	SA	A	A	A	SA	A	A	A	A	A	A	A
E	Y	A	D	SA	SA	SA	SA	SA	A	SA	D	D	SA	SA	SA	A	A	D	SA
C	Y	SA	SA	SA	SA	A	SA	SA	A	A	N	SA	D	A	A	A	D	D	A
D	Y	SA	SA	SA	SA	A	SA	SA	SA	SA	A	SA	A	SA	SA	SA	SA	SA	SA
E	Y	A	D	SA	SA	SA	SA	SA	SA	SA	SA	D	N	SA	SA	SA	SA	SA	SA
E	Y	A	SA	SA	A	A	SA	SA	SA	SA	SA	A	A	A	A	SA	N	SA	SA
C	N	A	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	A	A	A	SA	A	A	SA
D	N	SA	A	SA	SA	SA	SA	SA	N	SA	SA	SA	N	SA	SA	SA	SA	SA	SA
E	Y	A	A	SA	SA	SA	SA	SA	A	SA	SA	A	SA	SA	A	A	SD	A	SA
C	Y	A	D	SA	SA	D	SA	SA	A	A	N	D	A	SA	SA	SA	D	A	A
C	N	N	A	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A	A
D	Y	D	A	SA	A	A	SA	SA	SA	SA	A	A	SA	SA	SA	SA	A	A	SA
C	Y	A	A	A	A	A	A	A	N	A	A	D	A	A	A	A	N	A	A
D	Y	A	A	SA	SA	A	SA	SA	A	A	A	A	N	A	SA	SA	SA	SA	A
E	Y	SA	D	SA	SA	SA	SA	SA	A	SA	SA	D	SA	SA	SA	SA	N	N	SA
E	Y	A	N	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA
F	Y	A	N	SA	SA	A	SA	SA	N	A	A	D	A	N	A	SA	D	D	A
D	Y	N	A	SA	SA	SA	SA	SA	A	SA	SA	D	A	A	A	A	A	A	A
E	Y	SA	SA	SA	A	SA	SA	SA	A	SA	A	A	SA	SA	SA	SA	SA	A	SA
F	Y	A	D	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	A	SA
E	Y	A	A	SA	A	A	SA	A	A	SA	SA	D	SA	A	SA	SA	N	A	A
B	N	D	D	SA	SA	A	SA	A	SA	SA	SA	D	D	SA	SA	SA	SA	SA	SA
E	Y	A	A	SA	A	A	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA
B	Y	D	D	SA	A	A	SA	A	A	SA	SA	D	A	SA	SA	SA	SA	SA	SA
D	Y	A	N	SA	SA	A	SA	SA	SA	SA	SA	D	A	SA	SA	SA	SA	SA	SA
E	Y	A	D	SA	SA	SA	SA	SA	N	SA	A	D	A	SA	SA	A	A	A	SA
F	Y	A	N	SA	SA	N	A	A	D	A	A	N	SA	A	A	A	N	A	SA
F	Y	D	D	SA	A	D	SA	SA	N	SA	A	D	A	SA	SA	SA	SA	SA	SA
B	N	A	A	SA	SA	SA	SA	SA	SA	SA	A	A	D	SA	SA	SA	A	SA	SA
E	Y	SA	A	SA	SA	A	SA	SA	SA	SA	A	A	SA	SA	A	SA	N	N	A
E	Y	A	A	A	SA	A	A	A	A	SA	SA	A	SA	SA	SA	SA	A	SA	SA
D	Y	D	SD	SA	A	A	SA	SA	SA	SA	SA	SD	A	SA	SA	SA	SA	SA	SA
B	N	D	D	SA	SA	SA	SA	A	A	SA	SA	SD	D	SA	SA	SA	SA	SA	SA
E	Y	A	D	SA	A	SA	SA	SA	A	SA	SA	D	N	SA	SA	SA	SA	SA	SA
E	Y	A	N	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA
E	Y	SA	A	SA	SA	D	SA	SA	SA	SA	A	D	SA	SA	SA	A	SA	SA	SA
E	Y	D	SA	A	A	SA	SA	A	SA	SA	D	SA	SA	SA	SA	SA	SA	A	SA
C	N	N	N	SA	A	SD	SA	SA	A	SA	A	N	D	SA	A	A	A	A	SA
D	Y	N	N	A	SA	N	A	A	A	A	A	D	N	A	A	A	A	A	A
E	Y	N	A	SA	SA	SA	SA	A	SA	SA	A	D	A	SA	SA	SA	A	A	SA
B	N	A	D	SA	SA	A	SA	A	SA	SA	SA	D	SA	SA	SA	SA	SA	SA	SA
C	Y	A	D	A	SA	D	A	A	A	A	A	SD	A	A	A	A	A	A	A

P1Q19	P1Q20	P1Q21	P1Q22	P1Q23	P1Q24	P1Q25	P2Q1	P2Q2	P2Q3	P2Q4	P2Q5	P2Q6	P2Q7	P2Q8	P2Q9	P2Q10	P2Q11	P2Q12	P2
N	A	D	A	F	Y	N	SA	SA	SA	SA	A	SA	SA	SA	SA	N	A	SA	SA
SA	SA	SA	A	C	N	N	A	A	SA	SA	A	SA	SA	A	SA	A	SA	A	SA
D	SA	SA	SD	E	Y	Y	A	A	SA	SA	A	SA	SA	SA	SA	SA	A	SA	SA
SA	SA	SA	A	F	Y	N	SA	SA	SA	SA	A	SA	SA	A	SA	A	SA	SA	SA
SA	A	A	A	C	N	Y	A	SA	A	SA	A	A	A	SA	A	D	SA	N	A
D	N	SA	N	C	Y	N	N	N	SA	SA	A	SA	A	A	SA	SA	N	D	A
N	A	A	N	E	Y	Y	A	A	A	A	A	A	SA	A	A	A	A	A	A
A	SA	SA	A	D	Y	Y	A	A	SA	SA	SA	SA	SA	N	SA	A	A	A	SA
SA	A	A	A	E	Y	Y	A	SA	SA	SA	SA	SA	SA	A	SA	A	SA	SA	SA
D	SA	D	A	E	Y	Y	A	A	SA	SA	SA	SA	SA	A	SA	N	D	SA	SA
SA	D	SA	A	C	Y	Y	SA	SA	SA	SA	A	SA	SA	A	SA	N	A	D	A
SA	SA	SA	SA	D	Y	Y	A	SA	SA	SA	A	SA	SA	SA	SA	SA	SA	A	SA
D	A	SA	SA	E	Y	N	D	D	SA	A	A	SA	SA	SA	SA	SA	A	A	A
A	A	A	A	E	Y	Y	A	SA	SA	SA	A	SA	SA	SA	SA	SA	A	A	A
SA	SA	SA	D	D	Y	N	SA	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	A	SA
A	SA	SA	D	C	N	Y	A	SA	SA	SA	SA	SA	SA	A	SA	D	SA	A	SA
A	A	SA	A	E	Y	Y	A	A	SA	A	A	A	SA	SA	SA	A	A	SA	SA
D	SA	SA	A	C	Y	N	A	D	SA	SA	D	SA	A	A	A	SA	D	A	A
A	N	A	A	B	Y	Y	A	A	A	A	A	A	A	SA	SA	SA	SA	D	A
A	A	A	A	E	Y	N	N	SA	SA	A	A	SA	A	A	A	A	A	A	A
D	A	A	A	D	Y	N	A	A	A	A	A	A	A	A	A	N	A	A	A
A	SA	A	D	D	Y	Y	A	A	SA	SA	A	SA	SA	A	A	A	N	A	SA
D	SA	SA	D	E	Y	N	A	D	SA	SA	A	SA	SA	A	SA	SA	D	SA	SA
N	SA	SA	SA	E	Y	N	A	N	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA
N	SA	SA	A	F	Y	N	SA	A	A	SA	A	SA	SA	N	A	A	D	SA	SA
D	SA	SA	A	D	Y	N	N	D	A	SA	A	SA	SA	A	A	SA	D	A	SA
SA	SA	SA	D	E	Y	N	SA	SA	SA	SA	SA	SA	SA	A	SA	A	SA	SA	SA
D	SA	SA	D	F	Y	N	A	A	SA	SA	SA	SA	SA	SA	SA	A	SA	SA	SA
N	A	SA	A	D	Y	N	A	SD	SA	A	A	SA	SA	SD	SA	SA	SD	A	A
D	D	A	D	B	Y	N	A	D	SA	SA	SA	SA	A	SA	SA	SA	D	A	SA
A	A	SA	SA	E	Y	N	A	D	SA	SA	D	A	SA	SA	SA	SA	D	SA	SA
D	A	SA	D	B	Y	N	D	D	SA	A	A	A	D	N	SA	A	D	N	A
A	SA	SA	SA	D	Y	N	A	D	SA	SA	SA	SA	SA	A	SA	SA	D	SA	SA
D	A	A	A	E	Y	N	A	D	SA	A	A	A	SA	A	SA	SA	D	A	SA
N	SA	A	N	F	Y	N	A	N	SA	A	D	A	A	D	A	A	N	SA	SA
D	A	SA	N	E	Y	N	N	A	SA	A	D	SA	SA	A	SA	A	A	A	SA
A	SA	SA	A	D	Y	N	SA	SA	SA	SA	SA	SA	SA	SA	SA	D	A	A	SA
A	A	SA	N	E	Y	N	A	SA	SA	SA	A	SA	SA	SA	SA	A	SA	SA	SA
A	A	A	A	E	Y	N	A	A	A	SA	N	SA	SA	A	A	SA	A	A	A
SD	A	SA	D	D	Y	N	D	SD	SA	SA	SA	SA	SA	SA	SA	SA	SD	A	SA
D	SA	SA	N	B	N	N	D	D	SA	A	A	SA	A	SA	SA	SA	SD	D	SA
D	A	SA	A	E	Y	N	A	SD	SA	A	SA	SA	SA	A	SA	SA	SD	SA	SA
D	SA	SA	A	E	Y	N	A	N	SA	SA	SA	SA	SA	SA	SA	SA	D	SA	SA
A	SA	SA	D	E	Y	N	SA	D	SA	SA	SA	SA	SA	SA	SA	A	D	SA	SA
D	A	SA	A	E	Y	N	A	A	SA	A	A	SA	SA	SA	SA	SA	A	SA	SA
N	A	N	A	C	Y	N	N	N	SA	A	N	A	SA	A	A	A	N	N	A
N	A	A	A	D	Y	N	A	N	A	A	N	A	A	A	A	A	D	N	A
D	SA	SA	A	E	Y	N	A	A	SA	SA	SA	SA	SA	SA	SA	A	A	A	A
D	SA	SA	A	E	Y	N	A	D	SA	SA	A	SA	SA	SA	SA	SA	D	SA	SA
SD	A	A	N	E	Y	N	SA	D	A	N	N	SA	SA	SA	SA	SA	SD	N	SA

P2Q14	P2Q15	P2Q16	P2Q17	P2Q18	P2Q19	P2Q20	P2Q21	P2Q22	P2Q23	P2Q24	P2Q25	SHADE 1	SH
SA	SA	SA	SA	SA	SA	SA	SA	A	F	Y	N	A3	A2
SA	SA	A	A	SA	SA	SA	SA	A	C	Y	N	B4	B2
SA	SA	SA	SA	SA	A	SA	SA	D	E	Y	Y	B3	B2
SA	SA	A	A	A	SA	SA	SA	A	E	Y	N	B2	A1
A	SA	A	SA	A	SA	A	SA	A	B	N	Y	A3	A1
A	A	A	A	SA	D	A	SA	A	B	Y	N	B1	A1
A	SA	A	A	A	D	A	A	N	E	Y	Y	C3	C1
SA	SA	SA	SA	SA	A	A	SA	SA	D	Y	Y	A3	A1
SA	SA	SA	A	SA	SA	SA	SA	A	E	Y	Y	B2	A1
SA	A	A	D	SA	N	SA	SD	A	E	Y	Y	C4	A1
A	A	D	D	A	A	N	SA	A	A	Y	Y	C3	C2
SA	SA	SA	SA	SA	SA	SA	SA	SA	D	Y	N	B2	A1
SA	SA	SA	SA	SA	A	A	A	A	E	Y	N	A4	A1
SA	SA	N	SA	SA	A	A	A	SA	E	Y	Y	C2	A1
A	A	SA	SA	SA	SA	A	SA	D	D	Y	N	A2	A1
SA	SA	N	SA	SA	SA	SA	SA	N	E	Y	Y	D3	A1
SA	SA	D	A	SA	A	SA	A	A	E	Y	Y	A2	A1
A	SA	A	SA	A	D	A	A	A	C	Y	N	C3	C1
A	A	A	A	A	A	N	A	A	B	Y	N	B2	A1
A	SA	A	N	A	A	A	SA	A	E	Y	N	B4	B2
A	A	A	N	A	A	A	A	SA	D	Y	N	A2	A1
SA	SA	SA	SA	SA	A	SA	SA	D	D	Y	N	A2	A1
SA	SA	A	A	SA	D	SA	SA	A	E	Y	N	B4	B4
SA	SA	SA	SA	SA	D	SA	A	SA	E	Y	N	A3	A3
SA	SA	D	N	A	N	SA	N	N	F	Y	N	A2	A2
SA	SA	SA	A	A	D	A	SA	A	D	Y	N	A2	A2
SA	SA	SA	SA	SA	SA	SA	SA	D	E	Y	N	A3	A3
SA	SA	SA	A	SA	A	SA	SA	A	E	Y	N	B2	B2
A	SA	A	A	SA	SD	A	SA	A	D	Y	N	A3	A3
SA	SA	SA	SA	SA	D	A	SA	A	C	Y	N	A2	A2
SA	SA	SA	SA	SA	D	D	A	A	E	Y	N	B2	B2
A	A	A	A	A	D	A	N	N	B	Y	N	C2	C2
SA	SA	SA	SA	SA	D	SA	SA	SA	D	Y	N	B3	B3
SA	SA	SA	SA	SA	D	SA	A	A	E	Y	N	B4	B4
A	A	SA	SA	A	A	A	A	A	E	Y	N	A2	A2
A	SA	SA	A	SA	A	SA	A	A	E	Y	N	B2	B2
SA	SA	SA	SA	SA	SA	SA	SA	SA	E	Y	N	A2	A2
SA	SA	A	A	SA	SA	SA	SA	A	E	Y	N	A1	A1
A	SA	A	A	A	A	A	A	A	E	Y	N	B3	B3
SA	SA	SA	SA	SA	SD	A	SA	D	E	Y	N	A3	A3
SA	SA	SA	SA	SA	SD	SA	SA	N	C	N	N	B2	B2
SA	SA	SA	SA	SA	SD	SA	SA	SA	E	Y	N	C2	C2
SA	SA	SA	SA	SA	N	A	SA	SA	E	Y	N	A3	A3
SA	SA	SA	SA	SA	A	SA	SA	SA	E	Y	N	B2	B2
SA	SA	A	SA	SA	A	A	SA	A	E	Y	N	A3	A3
A	A	A	A	A	N	A	N	N	C	N	N	B3	B3
A	A	N	N	N	N	N	A	A	D	Y	N	A3	A3
SA	SA	SA	A	A	SA	A	SA	SA	E	Y	N	C1	C1
SA	SA	SA	SA	SA	D	SA	SA	SA	D	Y	N	A3	A3
SA	SA	SA	SA	SA	SD	SA	N	A	C	Y	N	A4	A4

APPENDIX J

CURRICULUM VITAE

Katie Jo Ballantyne Sargent

EDUCATION:

Courtland High School Spotsylvania, Virginia Dental Assisting Program	1998
Brigham Young University of Idaho Rexburg, Idaho Associate of Applied Science	2000
Old Dominion University Norfolk, Virginia Deans list Baccalaureate in Dental Hygiene	2004
Old Dominion University Norfolk, Virginia Masters in Dental Hygiene	anticipated May 2007

EXPERIENCE:

Graduate Teaching:

2004-2005 Graduate Teaching Assistant-Department of Dental Hygiene
Old Dominion University, Norfolk, Virginia
Responsible for clinical instruction for first and second year dental hygiene students and assisting faculty in various duties.

Work Experience:

June 1998-1999 Dental Assistant
Dr. Thomas Elstner
Fredericksburg, Virginia

June-December 2001 Orthodontic Assistant
Dr. John Coker

Fredericksburg, Virginia

August 2004-present Dental Hygienist
Dr. Gary Hartman
Virginia Beach, Virginia

June 2005-present Dental Hygienist
Dr. Adam Foleck
Norfolk, Virginia

Research Experience:

2004-present *Effects of Tooth Whitening Use on Oral Health Interests and Values of Adults.* Old Dominion University, School of Dental Hygiene, Norfolk, Virginia. Master Degree Thesis

2004 *Predictors of Oral Health Among the Virginia Elderly Population.* Mohammad Alzahrani, BSRDH, Katie Ballantyne, BSRDH, Akira Jennings Smothers, BSRDH (Graduate class)

ACTIVITIES AND HONORS:

2002-present Certified Cardiopulmonary Resuscitation
American Red Cross
Norfolk, Virginia

November 2003 Table Clinic Winners, First Place
Katie Ballantyne, Tara Rice, Kristy Alger, Leslie Lewis
Old Dominion University Department of Dental Hygiene
Norfolk, Virginia

December 2003 Undergraduate Student of the Month
Old Dominion University
Norfolk, Virginia

April 2004 Table Clinic Winners, First Place
Katie Ballantyne, Tara Rice, Kristy Alger, Leslie Lewis
North eastern Student Dental Hygienists' Association Conference
Poconos, Pennsylvania

July-August, 2004 American Dental Hygienists' Association, Student intern
Chicago, Illinois
Chosen as a student intern for the ADHA and the Sunstar Butler Company.

2005 - 2006 American Dental Hygienists' Association, Student representative
Joint Commission of Dental Examiners
Chicago, Illinois

Selected as the student representative for the Dental and Dental Hygiene National Board Committee

MEMBERSHIP IN PROFESSIONAL SOCIETIES:

2002-present Student American Dental Hygienists' Association (SADHA)

2004-present Virginia Dental Hygienists' Association (VDHA)

COMMUNITY SERVICE:

2003 Tangier Island Community Health Day
Tangier Island, Virginia
Provided oral cancer and pathology screenings for the community.

2003 Chesapeake Care Free Clinic
Chesapeake, Virginia
Assisted in oral surgery and provided oral prophylaxis for the underserved population.

2003 Children's Dental Access Day (sealant project)
Old Dominion University,
Norfolk, Virginia
Provided oral hygiene education for children, exposed and developed radiographs.

2004 Eggelston Services for handicapped adults
Norfolk, Virginia
Provided oral hygiene education for the mentally handicapped adults over a four week period.

2004 Children's Dental Access Day (sealant project)
Old Dominion University,
Norfolk, Virginia
Placed and sealants and provide oral hygiene education for children.

2004 Wesley Community Center (senior center)
Portsmouth, Virginia
Provided oral hygiene education for the elderly population.

2004	St. Mary's Home for the Disabled Children, Norfolk, Virginia Provided oral prophylaxis for severely disabled children and oral hygiene education for the nursing staff.
2004	John Tyler Elementary Portsmouth, Virginia Provided oral hygiene education for kindergarten students.
2004	Norfolk Healthcare Nursing Home Norfolk, Virginia Provided oral cancer screenings for elderly adults.
2005	St. Helena Elementary Norfolk, Virginia Provided oral hygiene education for elementary children.
2005	National Children's Dental Access Day (sealant project) Old Dominion University Norfolk, Virginia Examiner; Evaluated and approved dental sealants places by dental hygiene students.