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This is to certify that the thesis prepared by Larry D. Scarborough, Jr., entitled Self-perception of Smile Aesthetics and Self-esteem has been approved by his committee as satisfactory completion of the thesis requirement for the degree of Masters of Science in Dentistry.

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Self-perception of Smile Aesthetics and Self-esteem

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science
in Dentistry at Virginia Commonwealth University.

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Abstract**Self-perception of Smile Aesthetics and Self-esteem**

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A thesis submitted in partial fulfillment of the requirements for the degree of
Masters of Science in Dentistry at Virginia Commonwealth University

Virginia Commonwealth University, 2011

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Introduction: Self-perception of smile aesthetics has been suggested as the most common reason for seeking orthodontic treatment. A recent study concluded that an improvement of dental attractiveness at the end of orthodontic treatment had positive effects on self-esteem. The purpose of this study was to determine if a relationship exists between one's self-perceived smile aesthetics and their self-esteem. **Methods:** A survey was conducted where each subject completed an evaluation of their smile aesthetics and a Rosenberg Self-esteem Test (RST). A smiling photograph of each subject was evaluated by dental professionals for dental aesthetics and straightness. **Results:** Female students rated their teeth straighter than males (mean = 78.5, p value < .0001). Self-esteem varied by race (p = 0.0017). African Americans had the highest self-esteem. There was a significant relationship between a subject's satisfaction with their smile and their self-esteem (r = .30, p < .0001), but not with their self rating of their smile straightness (r = 0.11, p = 0.0528). **Conclusions:** Subjects with straight teeth perceived their smile as more aesthetic. Subjects that perceived themselves as having a more aesthetic smile had a higher self-esteem. Subjects that had orthodontic treatment in the past perceived their teeth were straighter and their smile was more aesthetic. There was no relationship between previous orthodontic therapy and self-esteem. Perception of smile aesthetics may be a more important aspect and a better predictor of self-esteem than a subject's actual smile aesthetics.

Introduction

There seems to be little controversy that appearance is a key element in social interaction and success. Many studies have documented the positive effects of physical attractiveness on relationships among adolescence, college students, and adults.¹ When comparing less attractive people with others, attractive people are considered to be more popular, extroverted, desirable dating partners, socially desirable, of a higher social class, and of greater intelligence.^{1,2} Dion et al,³ suggested that the existence of an attractiveness stereotype, “what is beautiful is good”, immediately projects positive qualities such as likeability, modesty, competence, friendliness, sensitivity, flexibility, leadership ability, achievement, and success in social and professional life.

An association between inner character and appearance has been reported because certain personality traits are influenced by one’s appearance and self-esteem. Cultural stereotypes of personalities appropriate for beautiful or unattractive people potentially mold the personalities of individuals and studies have indicated that one’s self-esteem develops directly from observing what others think about them.³ For example, if a person has a smile that is perceived as aesthetic by others and is consistently being treated as a virtuous person, he or she may in fact perceive him or herself as virtuous.

An important personality characteristic in an individual’s life is self-esteem. Self-esteem, described by Blascovich and Tomaka, is the extent to which one prizes, values, approves, or likes oneself and is commonly referred to by a variety of terms, including: self-worth, self-respect, self-regard, and self-acceptance.⁴ It usually develops from past experiences.⁵ Physical attractiveness is a major contribution to self-esteem and thus affects a person’s sense of well being.⁶ Kenealy et al⁷ and others^{8,9} stressed the important relationship between attractiveness and self-esteem, and showed they were significantly associated with each other. A person’s physical attractiveness has been shown in the literature to be a major factor in his or her life experiences, and therefore, it is expected that it influences self-esteem.⁵ Studies have shown that

an increased perception of attractiveness improves self-esteem.⁵ Studies consisting of university students have confirmed that self-esteem improves with physical attractiveness.^{5, 10, 11} Mathes and Khan reported that when judges rated physical attractiveness and self-esteem was measured by self-reported inventories, physical attractiveness was related positively to happiness and self-esteem and negatively with neuroticism.¹¹ Feingold found a correlation between self-perceived attractiveness and self-esteem.⁹ Based on the findings above, it is necessary to appreciate the role of facial attractiveness on overall attractiveness.

It is important to understand that a substantial portion of what makes up overall attractiveness is facial attractiveness. In fact, a recent study showed that both facial and bodily attractiveness were predictive of overall attractiveness, and the face emerged as the most powerful predictor.¹² Researchers have shown that individuals who display positive personality characteristics will have a face that is considered more attractive.¹³ Furthermore, facial attractiveness and smile attractiveness appear strongly connected to each other.¹⁴ In social interaction, one's attention is directed toward the mouth and eyes of the speaker's face.¹⁴ As the mouth is the center of communication of the face, the smile plays an important role in facial expression and appearance.¹⁴

Researchers have found that judgments of others concerning personality characteristics are influenced by dental appearance,¹⁵ and it is widely accepted that dental aesthetics contributes to facial and physical attractiveness, physical health, and beauty.¹⁶ Dental aesthetics is essential in overall physical attractiveness, and therefore, smile aesthetics has received a growing amount of attention from dental professionals in recent years.¹⁷ Adults with increased overjet, crowding, or deep bites,¹⁸ and adolescents with excessive anterior teeth display, have reported significantly lower self-esteem ratings and greater negative psychosocial impacts than those without a malocclusion.¹⁹

Badran²⁰ reported that dissatisfaction with dental aesthetics has a strong predictive effect on self-esteem. In fact, individuals with a low self-esteem rarely smile, report being teased about the appearance of their teeth, and believe that straight teeth improve one's popularity and success in life. Richmond et al²¹ looked at the aesthetic and dental components of the index of orthodontic treatment need (IOTN) and found that a panel of dentists regarded aesthetics as a greater need for treatment than dental health. In addition, Hunt et al²² showed when 14 dental health and psychological categories (such as, easier to clean teeth and reduction in teasing, respectively) were examined, orthodontists and general dentists rated an improvement of self-esteem and in physical attractiveness as the most important benefit of orthodontic treatment.

Orthodontics is a sought after therapy for both functional and aesthetic reasons, and an individuals' perception of orthodontic treatment need is multifactorial.²³ In many instances, orthodontic treatment is sought after only for its aesthetic benefit and is often justified on the assumption that receiving treatment will have a profound impact on physical appearance, psychological well being, and interpersonal relationships.²⁴⁻²⁶ This is a well supported assumption as studies have shown that dentofacial discrepancies and irregularities causing poor facial and dental balance negatively impact self-esteem.⁷ Birkeland et al²⁷ noted that a relationship between physical appearance and perception of dental aesthetics, and the impact of a deviation from the norm on self-esteem and body image are important issues when considering orthodontic treatment.

Several studies have illustrated the role of orthodontics in improving self-esteem and the overall psychological reward gained from receiving treatment.^{17, 20-22, 28-31} Many of these studies indicate an improvement in self-esteem during adolescence,^{17, 20, 22, 31} and others describe orthodontics as having little impact on psychological health after 6 months post treatment.^{28, 30} Badran²⁰ and Birkeland et al³² found weak evidence to suggest that individuals who have a positive perception of their dental aesthetics have a higher self-esteem. However, self-perception

of smile aesthetics and facial attractiveness have been suggested as the most common reasons for seeking orthodontic treatment and a predictor for deciding to undergo treatment for improvement of dental appearance.³¹ A recent study in 2009 concluded that, an improvement of physical attractiveness at the completion of orthodontic treatment had positive effects on psychosocial variables, including: self-esteem, social self-esteem, and performance.²⁰

Professionals tend to agree with individuals who perceive that they have a malocclusion or are in need of orthodontic treatment.^{20, 29, 32} However, in some cases, individuals with great need for orthodontic therapy do not express aesthetic concern, whereas others with ideal aesthetics, express unrealistic concern with the appearance of their smile.²⁹ Perceived need for treatment does not always coincide with a person's actual clinical need. In fact, researchers have consistently found that self-esteem is more related to the individual's perception of what others' evaluations of them are than by their own.³¹ Moreover, self-perceived dental attractiveness has a stronger association with the perceived severity of one's malocclusion, than with the actual clinical presentation. Perception is a more important contributing factor to self-esteem than the actual crowding or dental attractiveness.^{33, 34} Onyeason³⁵ reported a significant positive correlation between self-esteem and orthodontic concern.

Previous studies have varied in their findings on the relationship of smile aesthetics and self-esteem. A recent study found that adolescents who received orthodontic treatment had a higher self-esteem.²⁰ Adolescents with a perceived need for treatment demonstrated a negative self-evaluation of smile aesthetics and those with low self-esteem were less likely to smile.²⁰ These findings support that a dissatisfaction with dental appearance is a strong predictor for self-esteem.²⁰ Jung³⁶ found in an assessment of 4509 adolescents, that anterior crowding causes low self-esteem in girls and that significant improvements in self-esteem occur after orthodontic therapy. Adolescents showed similar levels of self-esteem after fixed treatment when compared to those with normal occlusion and a good profile.³⁶

Much of the current literature evaluating the relationship between self-perceived smile aesthetics and self-esteem or orthodontic treatment and an improvement in self-esteem, have studied children and young adolescent populations.^{19, 20, 28, 31, 34-36} The purpose of this study was to evaluate a university population consisting of late adolescent and young adults to determine if a relationship between self-perceived smile aesthetics and self-esteem exists. The null hypothesis tested in this study was: there is no relationship or association between self-perceived smile aesthetics and self-esteem in a population of university students. The specific aims of this study were:

- 1) To evaluate the relationship between self-perception of smile aesthetics, specifically perceived attractiveness and straightness, and self-esteem.
- 2) To evaluate for differences in the perception of smile aesthetics and self-esteem between gender, race, major, and previous orthodontic treatment.

In this study, subjects participated by evaluating their smile aesthetics and completing a Rosenberg Self-esteem Test (RST). Each subject evaluated their smile aesthetics/attractiveness using a 100mm Visual Analog Scale (VAS). The VAS is commonly used and has become the gold-standard mechanism for the measurement of subjective feelings, like perception, that yields interval data and is easy to administer and simple to understand.³⁷ The VAS is normally a horizontal line 100mm in length anchored by terms that represent the polar ends of the subjective phenomenon that is being measured. Subjects were asked to indicate their perception of their smile aesthetics and responses were recorded by measuring the distance from the lowest anchor point to the subject's vertical mark across the line.³⁷ Independent self-evaluation tools, via different approaches to evaluate the self-perception of dental or smile aesthetics such as Oral Aesthetic Subjective Impact Scale (OASIS),³² Standardized Continuum of Aesthetic Need (SCAN),³⁵ and the Visual Analog Scale (VAS),^{23, 38, 39} have all been used in the past in similar types of studies. The VAS can be applied to evaluate an individual's perception and has been

used successfully by authors evaluating dental aesthetics,⁴⁰ patient perceptions of smile aesthetics,⁴¹ and attractiveness in smile variations,⁴² in recent years.

To determine the psychological influence of self-perceived smile aesthetics the Rosenberg's Self-esteem Scale Test (RST)⁴³ was implemented. Several studies have used RST with validity and reliability for both orthodontic patients and the general population.^{20, 30, 36} Jung³⁶ and Vaida et al⁴³ used the RST to evaluate the effects of malocclusion and orthodontic treatment on self-esteem. Therefore, the literature supports the use of RST and VAS as a consistent, reproducible, and standardized testing tool.

Materials and Methods

Materials

Permission to administer the study survey was granted by the Virginia Commonwealth University's Institutional Review Board (IRB). The subjects in this study were Virginia Commonwealth University undergraduate students on the Monroe Park Campus in Richmond, Virginia. Students in both 100 and 200 level English classes were included in this study. Thirteen dental professionals from the Virginia Commonwealth School of Dentistry in the Department of Orthodontics in Richmond, Virginia participated in this study. The dental professionals comprised of 3 full-time orthodontic faculty members, 2 part-time orthodontic faculty members, 4 second-year orthodontic residents, and 4 first-year orthodontic residents.

Methods

A survey titled "English Class" was distributed to 287 subjects in 10 different English 100 and 200 level classes on the Monroe Park Campus of Virginia Commonwealth University. Each class and potential subject was given the choice to select one of three different options: 1) not to participate, 2) complete the survey only, and finally, 3) complete the survey and allow a peri-oral smiling photograph to be taken at the completion of the survey. Out of 287 potential subjects, 285 subjects chose to fully participate, and 2 chose not to participate at all. One hundred and fifty eight females and 127 male subjects participated in this study. Each "English Class" survey consisted of 18 questions. These subjects were given a description of the study and how their photograph would be used and subsequently given consent forms to allow use of their photographs in this study. The investigators obtained consent from the study subjects before the questionnaire was administered. Each participant completed the survey questions regarding their smile aesthetics from memory, without viewing their smile during this survey. Each subject was asked to answer all questions before having their smiling photograph taken (Figure 1).

Figure 1: Peri-oral photograph taken of each subject



The subjects took the survey on site in their respective 100 and 200 level English class. An investigator was on-site to address any questions the subjects had prior to completing the survey, but, the investigator did not address any questions while the subjects were filling out the survey. Each survey consisted of two sections, Section 1 and Section 2. Section 1 consisted of 8 questions (1-8). Questions 1-4 related to demographics (gender, race, age, and profession/major) and no questions were asked to obtain the subjects' birth date. Questions 5-8 related to their self-perceived smile aesthetics. Section 2 consisted of the Rosenberg Self-esteem Test (RST).

The Rosenberg's Self-esteem test is a ten item Likert scale with items answered on a four point scale - from strongly agree (SA) to strongly disagree (SD). Of the 10 questions, 5 are positive and 5 are negative. Items are scored: SA=3, A=2, D=1, SD=0. Items 2, 5, 6, 8 and 9 are reverse scored (SA=0, A=1, D=2, SD=3). The sum of the scores for the 10 items are tabulated. A larger number indicates a higher self-esteem. Scores below 15 suggest a low self-esteem, scores between 15-25 suggest a moderate self-esteem, and scores from 26-30 indicate a high self-esteem.

A VAS determination of self-perceived smile aesthetics and a Likert scaled test to measure self-esteem (RST) was given to each participant to investigate for any relationships or associations. Each subject was asked: *1) How do you feel about your smile? Please mark along this line to indicate how satisfied you are with your smile. 2) Do you feel your teeth are straight? Yes or No. Please mark along this line to indicate how straight or crooked you feel your teeth*

are, 3) *Have you had orthodontic treatment (braces)? Yes or No.* and 4) *How interested are you in having orthodontic treatment (braces)? Please mark along this line to indicate how interested you are in having orthodontic treatment (braces).* Section 2 consisted of 10 questions (1-10) and evaluated self-esteem using the Rosenberg Self-esteem Test (RST). All data was recorded and stored in Microsoft Access 2007 on a password protected computer by a research assistant in the Virginia Commonwealth University, Department of Orthodontics.

Finally, a separate survey titled “Dental Provider” was constructed to evaluate each subjects smiling photograph. Thirteen dental providers rated approximately 40 images that were randomly assigned to each rater. Each photograph was rated at least 3 times by different raters to evaluate inter-rater reliability. Photographs assigned to each rater were placed in a random order and then assigned a number, 1-40 to allow investigators to assess rater fatigue. Each rater was given the same specific instructions prior to participating and they were as follows: 1) *Please view the images for training before beginning your survey, you may return to them as much or as little as you feel necessary,* 2) *these images were selected from the 285 subjects by the investigator and separated into three general groups to represent a 0, 50, and 100 VAS Score (Figures 2 and 3),* 3) *each file contains subject images that fall into one of these three categories,* 4) *after viewing these images and discussing the “Dental Provider Survey” with the administrator you may begin rating your randomly assigned images. Thank you for your time in advance* and 5) *please note: when evaluating smile aesthetics you are looking at the smile in general. You should assess all things that make a smile aesthetic (crookedness, color, shape, spacing, gingiva on smile, etc.) When evaluating straightness of the teeth, please disregard the aforementioned. It is possible for a person to have an unaesthetic smile, but the teeth are straight, and vice versa.*

Figure 2: Selected images from the 285 subjects separated into three general groups to represent a 0, 50, and 100 VAS smile aesthetics score to calibrate professional raters

0_VAS Aesthetics



50_VAS Aesthetics



100_VAS Aesthetics



Figure 3: Selected images from the 285 subjects separated into three general groups to represent a 0, 50, and 100 VAS straightness score to calibrate professional raters

0_VAS Straightness



50_VAS Straightness



100_VAS Straightness



All 285 subjects' smiling photographs were rated using the survey titled "Dental Provider." Each survey contained 2 questions for the dental providers to answer using a 100 VAS, including: 1) *Please slide the cursor along this line to indicate how straight or crooked you feel these teeth are,* and 2) *Please slide the cursor along this line to indicate how attractive you feel this smile is.* The dental providers evaluated each photograph to determine whether the

patient had straight or crooked teeth and how attractive or unattractive the subjects smile was. Each dental provider was shown a photograph of a subjects cropped smile containing only the peri-oral complex and asked to rate it using a sliding 100mm VAS. All data was automatically entered into the database as the rater completed their survey.

Statistical Methods

All data was reviewed and analyzed for any relationships and associations. The variables included, but were not limited to: race, gender, age, orthodontic treatment received, orthodontic treatment not received, level of self-esteem, satisfaction of smile attractiveness, and straight vs. crooked teeth.

Using the data obtained from the 285 “English Class” subjects, picture ratings were analyzed using regression analyses (SAS version 9.1, SAS Institute, Cary, NC). Significance was tested at $\alpha = 0.05$. Subject factors (gender, race, and age), and picture factors (perceived attractiveness satisfaction) were taken into account when testing for crooked vs. straight differences. Interaction tests were used to determine if main effects were consistent across other factors. Agreements between raters (intra-rater reliability) and agreements between subjects and raters (inter-rater reliability) were described using the intra-class correlation coefficients. Differences between correlations were tested using multiple regression analysis. Responses of the classroom subjects and the professionals’ ratings were summarized using percentages or means, depending upon the data. When comparing subject groups (i.e., gender and race) an ANOVA was used and when testing for associations a test for a significant correlation was used. All analyses were performed using SAS software (JMP version 8.0.2, SAS Institute, Inc., Cary NC). Agreement between professional raters was summarized using both simple correlation and intra-class correlation.

Results

Outline

The outline of our results is as follows: first we will consider the classroom survey; then the professional ratings; and finally we will review the relationship between the classroom survey and the professional ratings.

Classroom survey

In the N=285 “English Class” survey subjects, 55% were female (n = 158) and the average age was 20.5 (SD = 3.68). The ethnicity was 57% Caucasian (n = 162), 22% African American (n = 62), 14% Asian (n = 40), 4% Hispanic (n = 11) and 3.5% other (n = 10).

The questions relating to smile aesthetics and straightness are summarized in Table I.

Table I: Self-perception of smile aesthetics

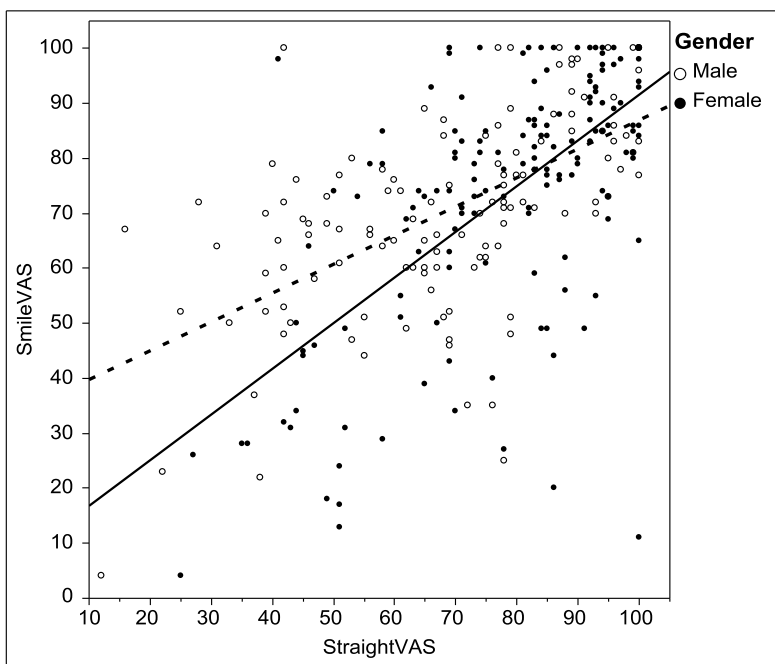
Survey Question	N	Mean	SD
<i>How do you feel about your smile?</i>			
VAS	285	72.4	21.25
<i>Do you feel your teeth are straight?</i>			
Yes	197	69.6%	
No	86	30.4%	
VAS	285	74.3	19.81
<i>Have you had orthodontic treatment (braces)?</i>			
Yes	162	56.8%	
No	123	43.2%	
<i>Are you interested in having orthodontic treatment (braces)?</i>			
Yes	75	26.3%	
No	208	73.0%	
Braces now	2	0.7%	
VAS	283	24.3	30.81

Abbreviations: VAS = visual analog scale (0 to 100mm), SD = standard deviation

Overall, subjects felt positive about their smile (mean = 72.4) and 70% felt that their teeth were straight. The VAS straightness mean was 74.3, although straightness ratings ranged between 12

and 100. There was no relationship between gender, age, or race and the VAS smile aesthetics or the VAS straightness (p values > 0.2) except for gender and VAS straightness. Female students rated their teeth straighter than males (mean = 78.5 versus 69.0, p value $< .0001$). Overall, there was a relationship between the VAS straightness of a smile and the VAS of how a subject felt about their smile aesthetics, but the relationship was different for males and females ($p = 0.0032$) (Figure 4). The correlation in males (dark solid line) was $r = 0.60$ and the correlation in females (dotted line) was larger ($r = .63$).

Figure 4: Relationship between straightness and satisfaction by gender



The self-esteem items were summarized in Table II. The percentages were calculated on the basis of 285 subjects responding to the rating scale. On the first item, "... I am satisfied with myself", 44% strongly agreed and only $n=1$ subject strongly disagreed. The average student scored 23.7 on the Rosenberg Self-Esteem Scale ($SD = 4.66$, range = 7 to 30). Only $n = 8$ subjects had low self-esteem (score of below 15).

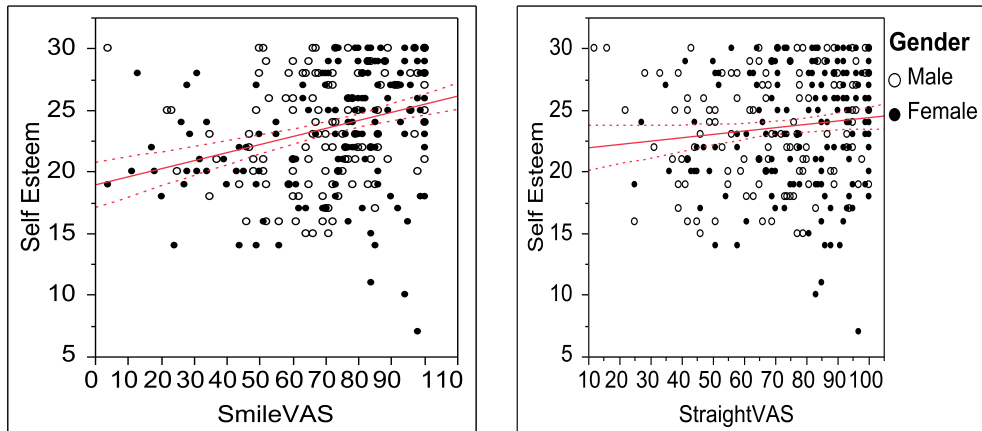
Table II. Rosenberg self-esteem items (N and %). *Items that were reverse scored. Abbreviations: SA = strongly agree, A = agree, D = disagree, SD = strongly disagree with others

Rosenberg's Self-esteem items	SA	A	D	SD
On the whole, I am satisfied with myself.	125 (44%)	146 (51%)	13 (5%)	1 (0%)
At times, I think I am no good at all.*	5 (2%)	62 (22%)	101 (35%)	117 (41%)
I feel that I have a number of good qualities.	160 (56%)	123 (43%)	2 (1%)	0 (0%)
I am able to do things as well as most other people.	151 (53%)	129 (45%)	5 (2%)	0 (0%)
I feel I do not have much to be proud of.*	2 (1%)	14 (5%)	101 (35%)	168 (59%)
I certainly feel useless at times.*	5 (2%)	75 (26%)	97 (34%)	108 (38%)
I feel that I'm a person of worth, at least on an equal plane with others.	165 (58%)	115 (40%)	4 (1%)	1 (0%)
I wish I could have more respect for myself.*	20 (7%)	87 (31%)	91 (32%)	87 (31%)
All in all, I am inclined to feel that I am a failure.*	3 (1%)	7 (2%)	80 (28%)	195 (68%)
I take a positive attitude toward myself.	140 (49%)	127 (45%)	15 (5%)	3 (1%)

Self-esteem did not vary by gender ($p = 0.84$), age ($p = 0.46$), but did vary by race ($p = 0.0017$). Tukey's HSD multiple comparison procedure indicated that African Americans had the highest self-esteem (mean = 25.6) and this was higher than Caucasians, Asians, or Others (mean = 23.1). Hispanics were in the middle (mean = 23.9) and not significantly different than any other ethnicity.

There was a significant relationship between a subject's satisfaction with their smile and their self-esteem ($r = .30$, $p < .0001$), but not with their self rating of their smile straightness ($r = 0.11$, $p = 0.0528$) (Figure 5).

Figure 5: Self-ratings: correlation with self-esteem



In a multiple regression analysis that adjusted for gender, age, and race differences, there was still no evidence for a relationship between straightness and self-esteem ($p = 0.0532$). In this analysis, the partial correlation between straightness and self-esteem appeared low ($r = 0.12$).

Ratings by professionals

The dental professionals rated the straightness and attractiveness of all $N=285$ smile pictures. There were a total of 13 dental professionals participating in the ratings and it was not possible for all professionals to rate all of the smile pictures. So it was decided that the professionals would rate as many as 40 pictures to avoid any fatigue during the rating which could bias the results. In order to compare professionals' ratings, most of the pictures were rated by two, three, or four professionals. The pairing of professionals was done to insure that each subject's image was rated by at least two raters [except for E and I that were only paired once]. In the 78 pairings, there were 16 cases where the same pair was rated by 4 professionals (20.5%) and there were 42 cases where the same pair was rated by the same 3 professionals (53.8%).

There were two ratings of each picture, first smile straightness: There were $n=513$ straightness ratings of the 285 student pictures. The average was 71 ($SD = 24$, range = 0 to 100). Approximately 10% were below a VAS straightness of 35. In order to compare dental

professionals, their average ratings were first compared (see Table III). The dental professionals (reviewer “A” through “M”) had averages as high as 78 (reviewer “J”) and as low as 53 (reviewer “K”) (Table III). An ANOVA indicated that these means were significantly different ($p = 0.0007$) and Tukey’s HSD multiple comparison procedure indicated that reviewer “K” was significantly lower than all other raters except reviewers “C” and “G”. The average difference between a rater and all the other raters of the same picture is shown in the “difference with others” column of Table III. Reviewer “K” gave biased ratings that were on average approximately 18 VAS units below their colleague’s ratings (Table III).

Table III. Ratings of straightness by dental professionals

Reviewer	N	Straightness		N	Difference with others		Correlation with others
		Mean	SD		Mean	SD	
A	40	71.68	23.11	36	-1.14	19.66	0.71
B	40	75.45	26.74	36	7.36	21	0.57
C	39	69.41	22.38	34	-2.35	15.21	0.78
D	41	73.56	28.64	35	3.89	16.91	0.8
E	40	74.65	19.03	35	3.94	17.6	0.64
F	39	75.97	28.52	36	3.47	18.92	0.77
G	39	65.23	22.87	35	-2.69	21.93	0.54
H	39	70.87	25.78	34	1.97	20.51	0.7
I	36	73.22	22.56	33	0.42	16.77	0.67
J	40	77.95	21.24	36	1.89	18.7	0.65
K	40	52.7	21.54	36	-18.36	17.72	0.7
L	40	72.23	25.2	35	2.06	17.61	0.77
M	40	70.9	17.4	37	-0.24	19.34	0.66

However, even if a reviewer was biased, the ratings were still highly correlated. Overall, the ratings of the same picture were highly correlated, $r = 0.67$ (Figure 6A and 6B).

Figure 6A and 6B: Relationship between one reviewer's straightness rating and the others' ratings

Figure 6A

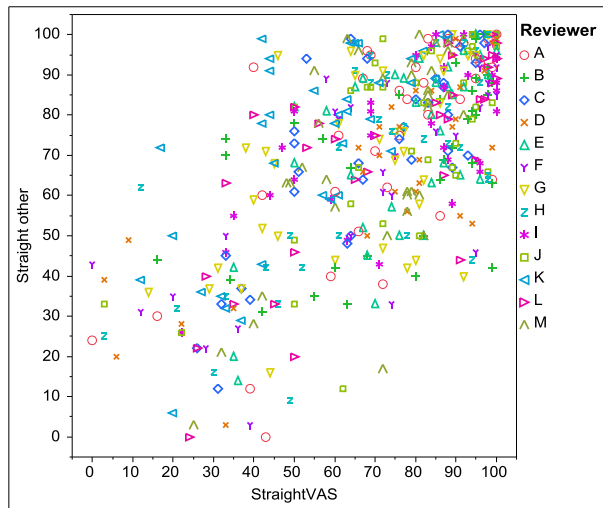
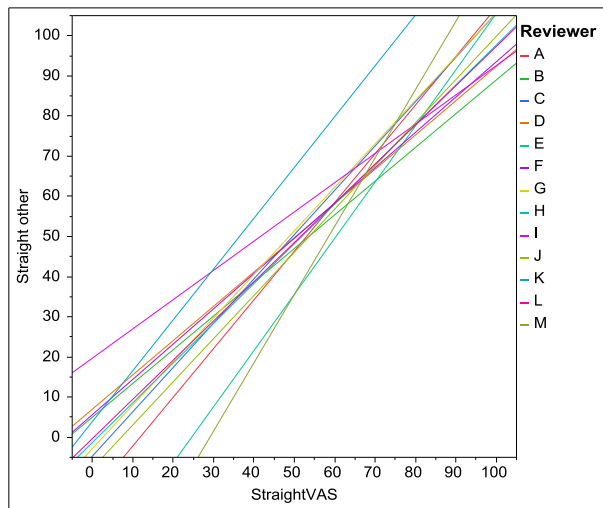


Figure 6B



However, the correlation between one reviewer's straightness rating and all of the other reviewers is shown in the last column of Table III and there was some evidence that the correlations might be different ($p = 0.0836$). This is shown in Figure 6B, where it was clear that there was not a 1-to-1 relationship. If there were perfect correlation ($r = 1$) the line would have slope = 1. The bias in reviewer "K" line was evident as it is above all the others and indicated this rater's bias. The correlations in the last column of Table III indicate that reviewers "B" ($r = 0.57$) and "G" ($r = 0.54$) had the lowest correlation with others and reviewer "D" had the highest ($r = 0.80$). The intra-class correlation was essentially the average correlation between raters and it was estimated to be $r_{ICC} = 0.68$.

The other rating of each picture was of attractiveness: There were $n=513$ attractiveness ratings of the 285 student pictures. The average was 54 ($SD = 27$, range = 0 to 100). Approximately 10% were below a VAS attractiveness of 16 or above an attractiveness of 89. In order to compare dental professionals, their average ratings were first compared (Table IV). The dental professionals had averages as high as 64 (reviewer "E") and as low as 39 (reviewer "K"). ANOVA indicated that these means were significantly different ($p = 0.0027$) and Tukey's HSD multiple comparison procedure indicated that reviewer "K" was significantly lower than only the reviewers "E", "J", and "G". We also noted that reviewers "B" and "F" had larger standard deviations in their ratings; they used a broader range when making their assessment. The average difference between a rater and all the other raters of the same picture is shown in the "difference with others" column of Table IV. Again, reviewer "K" gave biased ratings that were approximately 14 VAS units below the others.

Table IV: Ratings of attractiveness by dental professionals

Reviewer	<i>Attractiveness</i>			<i>Difference with others</i>			<i>Correlation with others</i>
	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	
A	40	55.28	24.07	36	-1.31	24.65	0.64
B	40	47.73	31.44	36	-3.53	22.61	0.69
C	39	53.33	26.05	34	-2.74	18.45	0.76
D	41	50.32	27.5	35	-8.77	26.03	0.51
E	40	63.88	23.86	35	9.57	20.92	0.63
F	39	59.28	33.34	36	3.25	24.33	0.71
G	39	59.36	23.68	35	5.54	25.4	0.49
H	39	48.95	29.84	34	-6.06	24.72	0.63
I	36	55.92	28.05	33	-0.85	25.78	0.47
J	40	62.05	24.9	36	7.47	22.65	0.61
K	40	39.4	23.51	36	-14.39	24.03	0.58
L	40	58.8	23.73	35	14.54	17.65	0.79
M	40	51.63	23.1	37	-2.65	22.48	0.62

The correlation of the attractiveness ratings between reviewers was considered next.

Overall, the ratings of the same picture were high, $r = 0.60$ (Figure 7B).

Figure 7A and 7B: Relationship between one reviewer's attractiveness rating and the others' ratings

Figure 7A

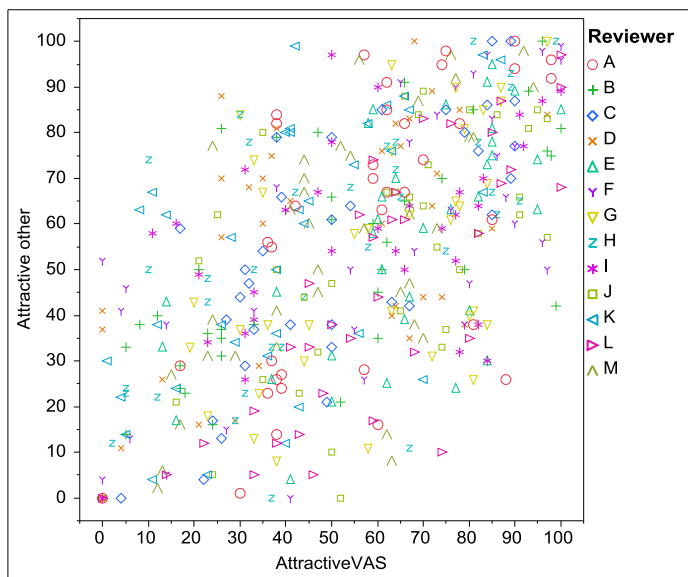
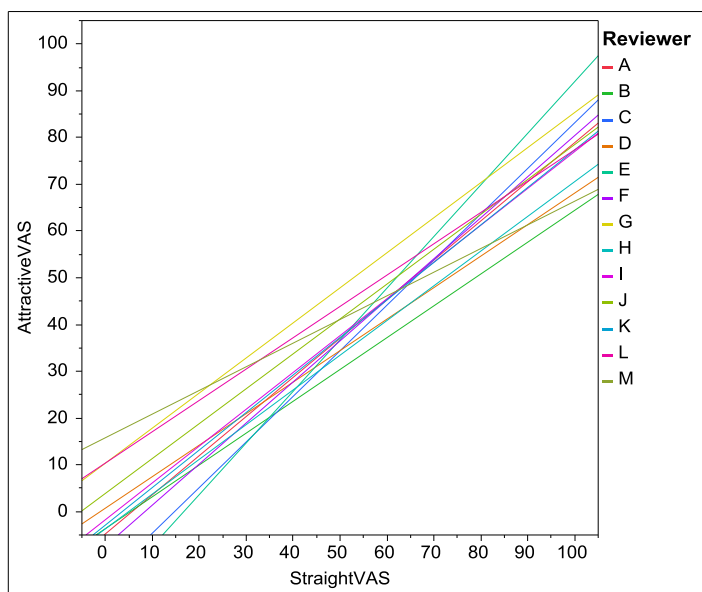


Figure 7B

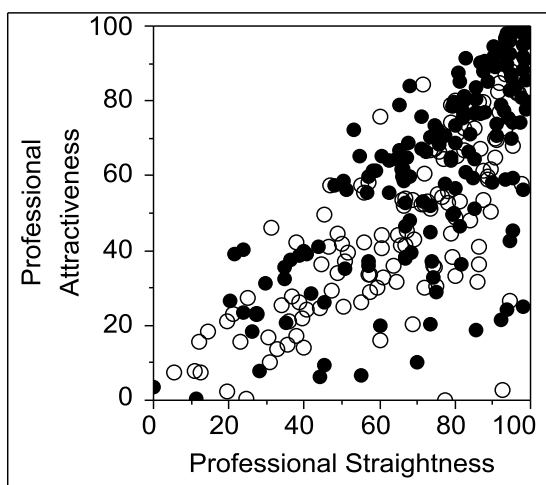


However, the correlation between one reviewer's attractiveness rating and all of the other reviewers is shown in the last column of Table IV, but there is no evidence that the correlations may be different ($p = 0.3731$). This is shown in Figure 7B where it is clear that there

is not a 1-to-1 relationship. The bias in reviewer “K” line is evident where it is above all the others. The intra-class correlation was essentially the average correlation between raters and it was estimated to be $r_{ICC} = 0.60$.

The relationship between the smile straightness ratings by dental professionals and their attractiveness ratings was considered next. As may be seen in Figure 8, there is an interesting “lower triangle” form to the scatter plot.

Figure 8: Relationship between professional straightness and professional attractiveness



The lack of ratings in the upper-left corner indicated that a straightness rating was upper bound for the attractiveness rating. Overall, the two ratings were correlated ($r = 0.69$) (Fig 7B).

However, the correlation between attractiveness and straightness did vary depending upon the reviewer (Table V). The first two columns in Table V were repeated from the previous two tables and they show the correlation of one reviewer’s rating with the other’s ratings. The column labeled “Cross” is the cross correlation between attractiveness and straightness for each reviewer.

Table V: Correlations

Reviewer	<i>Correlation with others</i>		
	<i>Straight</i>	<i>Attractive</i>	<i>Cross</i>
A	0.71	0.64	0.8
B	0.57	0.69	0.58
C	0.78	0.76	0.84
D	0.8	0.51	0.7
E	0.64	0.63	0.88
F	0.77	0.71	0.75
G	0.54	0.49	0.72
H	0.7	0.63	0.64
I	0.67	0.47	0.63
J	0.65	0.61	0.64
K	0.7	0.58	0.73
L	0.77	0.79	0.71
M	0.66	0.62	0.38

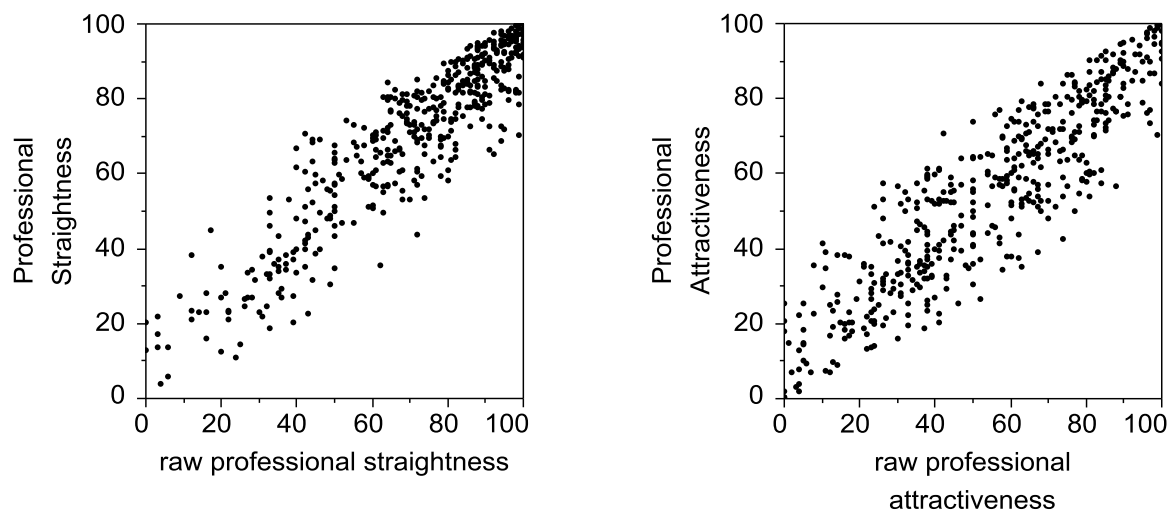
The information in Table V and the observed bias of reviewer “K” gave us a basis to judge the comparability of the reviewers. Clearly reviewer “K” gave ratings that were lower than others, but these ratings seem correlated with others and the ratings of straightness and attractiveness were also correlated.

We chose raters on the basis of four factors: 1) unbiased, 2) acceptable correlation of straightness ratings with others’, 3) acceptable correlation of attractiveness ratings with others’, and 4) acceptable correlation between straightness and attractiveness. Reviewers A, C, E, F, H, J, and L seemed to meet these criteria. The most clearly superior raters were reviewers C, F, and L.

The intent of comparing reviewers was to determine a method whereby a single rating of every picture could be obtained. That is, a multiple regression equation was used to calculate the professional rating of each picture “as if” a single best rater had evaluated all of the pictures. We chose that rater on the basis of four factors: 1) smallest differences with other raters, 2) highest correlation of straightness ratings with others’, 3) highest correlation of attractiveness ratings with others’, and 4) highest correlation between straightness and attractiveness. From the

information in Table V on correlations and the information in Tables III & IV on differences, rater C was chosen. A repeated-measures multiple-regression model combined all the information on subjects' ratings to form the predicted rating that would have been obtained if rater C had rated all of the pictures. Additionally, since the analyses also indicated a small but significant trend in the ratings from the first picture rated until the last picture rated, the predicted professional rating also removed this trend by predicting the rating that would have been obtained in the middle of this trend (rating number 20). That is, the professional rating used in subsequent analyses removed the differences between raters and the picture-order trend. Figure 9 showed the relationship between the original rating by professional and the corrected professional ratings.

Figure 9: Relationship between the original rating by professionals and the corrected professional ratings



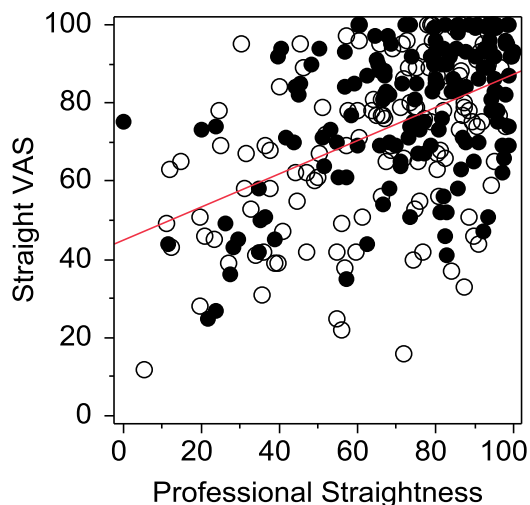
Correlation between Professional Ratings and Subject Ratings

Here, we consider the relationship between professional ratings and subject ratings (Figure 10 and 11). In Figure 10, there was a relationship between the professional rating of straightness and the subject's rating of straightness. Although the self ratings were 4.74 units

higher than the professional rating (paired t-test = 3.7, $p = 0.0003$), there was a clear, positive relationship ($r = 0.49$, $p < .0001$). As with self-perception of straightness, the professional rating of straightness was higher for females than males (mean = 73.9 versus 64.0, $p = 0.0003$).

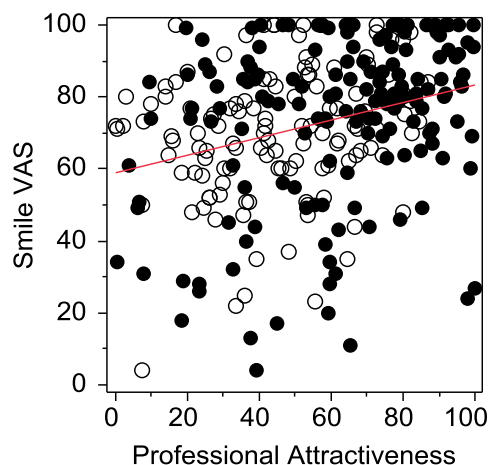
Although self ratings of attractiveness did not vary by gender, professional ratings of attractiveness was higher for females than males (mean = 61.9 versus 45.4, $p < .001$).

Figure 10: Straightness – the relationship between professional and self ratings



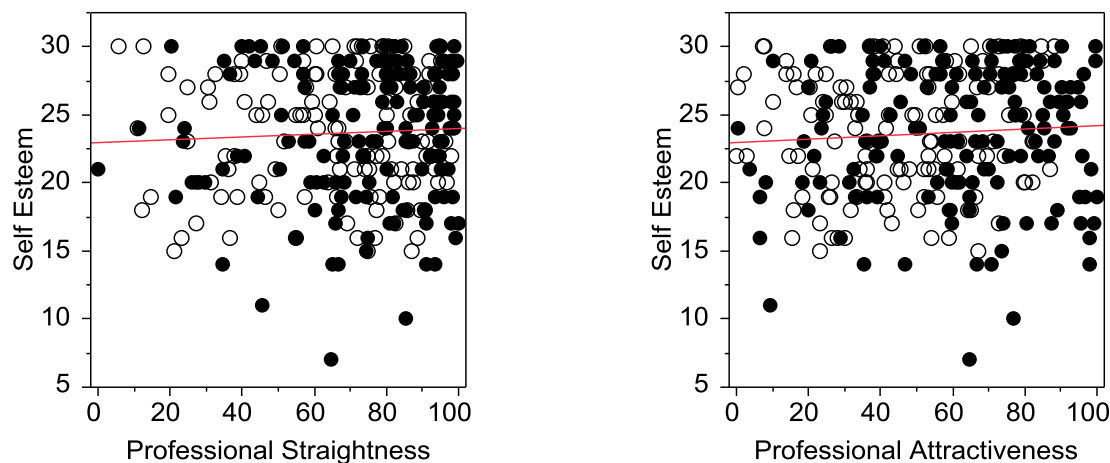
In Figure 11 we see the relationship between the professional rating of attractiveness and the subject's rating of satisfaction with their smile. Although the self ratings are 17.8 units higher than the professional rating (paired t-test = 11, $p < 0.0001$), there was a clear, positive relationship ($r = 0.29$, $p < .0001$).

Figure 11: Attractiveness – the relationship between professional and self ratings



There is, however, no relationship between a professional's rating of straightness and subject self-esteem ($r = 0.05$, $p = 0.41$). Nor is there evidence for a relationship between a professional's rating of attractiveness and subject self-esteem ($r = 0.07$, $p = 0.25$). See Figure 12.

Figure 12: Professional ratings and self-esteem



Differences between the Orthodontic Groups

The differences between subjects who did and did not have previous orthodontic treatment are shown in Table VI. In all cases except self-esteem ($p = 0.720$), those with braces

had higher ratings. Subjects that had previous orthodontic treatment were more pleased with their smile ($p < 0.002$) and thought their teeth were straighter ($p < 0.001$). Professional ratings of smile attractiveness ($p < 0.001$) and straightness ($p < 0.001$) were also higher for subjects that had orthodontic treatment.

Table VI. Differences due to braces

Braces	<i>n</i>	Mean	SE	95% CI		<i>p</i> -value
Smile VAS						
Yes	162	75.89	1.64	72.65	79.12	
No	123	67.89	1.89	64.18	71.61	
Difference		8	2.5	3.07	12.92	0.002
Straight VAS						
Yes	162	78.1	1.52	75.11	81.09	
No	123	69.21	1.74	65.78	72.64	
Difference		8.89	2.31	4.33	13.44	<.001
Self Esteem						
Yes	162	23.78	0.37	23.06	24.5	
No	123	23.58	0.42	22.75	24.41	
Difference		0.2	0.56	-0.9	1.3	0.72
Professional Straightness						
Yes	162	77	1.67	73.71	80.29	
No	122	59.51	1.93	55.72	63.3	
Difference		17.49	2.55	12.48	22.51	<.001
Professional Attractiveness						
Yes	162	59.89	1.92	56.11	63.67	
No	122	47.44	2.21	43.08	51.8	
Difference		12.45	2.93	6.68	18.22	<.001

The p-value for the t-test is shown.

Discussion

The general purpose of this study was to test the relationship of self-perceived smile aesthetics and self-esteem. Additionally, we evaluated for differences between gender, race, age, previous orthodontic treatment, and professional ratings when compared to the subjects ratings.

An important personality characteristic in a person's life is self-esteem.⁵ As children grow and develop life experiences, they are molding their self-concepts. Although self-esteem develops from adolescence into adulthood, it is important to understand that it continues to be altered, reshaped, and modified throughout life.⁴⁴

Orthodontists often cite anecdotally that with an aesthetic smile comes an increase in self-esteem. This was confirmed when Hunt et al²² showed that an improvement of self-esteem was the most important outcome of orthodontic treatment when surveying orthodontist and general dentists. A recent study in 2009 confirmed Hunt's findings and also concluded that, an improvement of overall physical attractiveness at the completion of orthodontic treatment had positive effects on self-esteem.²⁰

The sample in this study included subjects from the Virginia Commonwealth University and represented an almost exact replica of the actual demographics reported for the VCU student body in 2011. This study specifically targeted 100 and 200 level English classes to attain the most diverse sample population relative to, age, gender, race, and background. English classes are traditionally taken by all registered freshman and sophomore students, which allowed for a great cross-sectional representation of this university population. Previous studies surveying universities chose to implement their surveys in multiple departments to accomplish a diverse sample population⁴⁵ or to randomly select freshman from the enrolled students to eliminate the potential for any biases.⁴⁶ These studies achieved a diverse and representative study population, and although the present study used a different methodology, it was also successful in recruiting a diverse population within VCU.

To understand the findings in this study, it is important to remember that previous studies on perceptions of malocclusions and the implications of orthodontic treatment involved young adolescent populations.^{19, 20, 28, 31, 34-36} Additionally, a follow-up study¹⁸ of orthodontically untreated and treated subjects 15-20 years post-treatment was done to determine relationships between perceived malocclusions and self-esteem. This study by Helm et al¹⁸ showed that highly significant differences were found between treated and untreated subjects in recalling the unfavorable perception of their teeth. The authors concluded that malocclusions may adversely affect self-concept not only in adolescence, but also in adulthood.¹⁸

The present study described a university population in an attempt to reveal a relationship between self-perception of smile aesthetics and self-esteem. It is interesting to note that in young adolescent subjects, orthodontic treatment has been shown to improve self-esteem,²⁰ but the degree to which this carries on into late adolescence and/or early adulthood is unknown.

The findings of this study will be discussed in the following three sections: subject findings, professional findings, and the relationship between the two groups.

Subject findings

In this sample population the subjects generally felt positive about their smile aesthetics and straightness. Over half of the subjects had previous orthodontic treatment and more than 70% were not interested in receiving treatment. The average self-esteem score was relatively high. The Rosenberg Self-esteem Test is scored from 0-30. Anything below a score of 15 is considered a low self-esteem, between 15-25 an average or moderate self-esteem, and over 25 a high self-esteem. The subjects in this study tested as having an average score of 23.7 or a moderate to high self-esteem. Only 8 subjects tested below 15. Woods et al⁴⁷ researched the effects of self-esteem on education level and showed that those with a higher level of self-esteem do better in school and therefore, receive more education. Our results mimic this example of positive reinforcement and exemplified that those with more education have a higher level of

self-concept and those with a higher self-concept sought more education. Studies have shown that people with low self-esteem try to avoid exposing their unfavorable characteristics, and by doing so, they avoid anything that may risk exposing any shortcomings. Therefore, they are less likely to take on any challenges that may also bring rewards, such as furthering their education.⁴⁷ Our sample population illustrated convincingly, that college students have a high self-esteem, which was in agreement with Woods study.⁴⁷ In regard to the number of subjects with a low self-esteem in our sample population (8 total), our findings suggest an enhancement of self-esteem, but are less likely to suggest a difference when comparing low to high self-esteem subjects. However, it is also important to understand that this is speculative, because this study does not describe the subjects previous self-esteem. Our study is cross-sectional in design and does not account for each subjects previous history of self-esteem. Hence the relevance of a longitudinal study, which allows for comparison of before and after self-esteem levels would improve the clinical significance of this study.

The subjects in this study had a relatively high self-esteem overall, but African Americans had a significantly higher self-esteem than other race categories. This finding was difficult to understand and this question needs further investigation. In previous research, little differences have been found regarding age, race, and gender in adolescent groups from ages 10-18.⁴⁴ However, Frost and McKelvie⁴⁸ suggested that self-esteem was lower for females than male students, and high school students than for elementary or university students. Furthermore, the finding of a higher self-esteem for university students compared with high school students by Frost and McKelvie⁴⁸ positively reinforces our findings of an overall high self-esteem in this university study population.

Females rated their smile as straighter than males. Previous studies indicate that females were more critical than males and were more conscious of their dental attractiveness.⁴⁹ It was

suggested that this might be due to higher expectations of dental attractiveness for females than males.⁴⁹

Smile aesthetics and straightness were positively correlated. As a subjects smile straightness improved so did their smile aesthetics. The results of this study implied that smile straightness was an important factor when considering smile aesthetics, especially when considering the professional raters preception. Professional raters were more likely to give a higher rating for smile aesthetics when the teeth were straight. Previous studies have indicated that smile aesthetics is also related to characteristics of smile aesthetics, including buccal corridors, gingiva on smile, lip to tooth, and color.^{42, 50} Our study did not separate these individual characteristics, although they would be interesting to evaluate in a future study.

There was a positive correlation between self-perception of smile aesthetics and self-esteem, but not straightness of the teeth and self-esteem. Interestingly, this study suggests that if one perceived their smile as aesthetic, they had an improved self-esteem. However, if a person perceived their teeth as straight, this did not improve their self-esteem. Our results can be explained by the simple suggestion that the increase in self-esteem was based more heavily on a perception of smile attractiveness rather than the subjects actual dental attractiveness. Our findings are in agreement with a previous study by Phillips and Beal³⁴ which reported that self-perceived dental attractiveness or a positive feeling towards their peri-oral region was more related to self-esteem than the severity of the malocclusion alone. Furthermore, our findings showed no relationship between a professional's rating of smile attractiveness and a subject's self-esteem. Smile aesthetics and straightness were correlated, but straightness was not significantly related to self-esteem. This may suggest that a higher self-esteem was associated with people that had varying degrees of malocclusion, but felt that their teeth were aesthetic. Researchers have consistently found that self-esteem is more related to the individual's perception of others' evaluations of them more than by their own.³¹ Furthermore, self-perceived

dental attractiveness is more strongly associated with the perceived severity of one's malocclusion, than with the actual clinical presentation. Perception is more of a contributing factor to self-esteem than the actual crowding or dental attractiveness.^{33,34}

Subjects that had previous orthodontic treatment gave higher ratings for their smile aesthetics and straightness, but did not have a higher self-esteem. Several studies have illustrated the role of orthodontics in improving self-esteem and the overall psychological reward gained from receiving treatment.^{17, 20-22, 28-31} Many of these studies indicate an improvement in self-esteem during adolescence,^{17, 20, 22, 31} and others describe orthodontics as having limited impact on psychological health after 6 months post treatment.^{28, 30} Furthermore, a prospective study evaluated an adult sample before, during, and after orthodontic treatment and found an improvement in perceived overall attractiveness 6 months after the start of orthodontic treatment.⁵¹ Facial body image did not improve until after the orthodontic appliances were removed, and self-esteem did not change overtime.⁵¹

Subjects that had a history of previous orthodontic treatment viewed their smile as straighter and more aesthetic. However, subjects that had previous treatment did not show a significant difference in self-esteem.

This study does not support the relationship between previous orthodontic therapy and an increase in self-esteem. This is in contrast to a recent publication, where Jung³⁶ showed that malocclusion and fixed orthodontic appliance treatment can improve self-esteem in girls. However, similar studies done by Shaw³⁰ found little long term effect and that the increase in self-esteem did not carry out into adulthood. It is known that self-esteem is multifactorial and it is unwise to assume that it is one-dimensional.⁴⁴ It is possible that as a person matures, he or she tends to change their focus from teeth to other features that can make up attractiveness, such as, daily activities, success in school, sports, career, life, body size, etc. Self-esteem is multidimensional in nature and it is extremely difficult to establish a relationship with self-

perception of smile aesthetics. Dental attractiveness seems to be more important during the most critical stages of skeletal and dental growth and development. Studies^{28, 30} seem to indicate that an improvement in self-esteem is measurable during adolescence, suggesting an increase in focus on dental aesthetics during that period of one's life. It is possible that orthodontic treatment has its greatest impact on self-esteem when treatment is rendered during young adolescence.

Self-esteem may be more heavily impacted by items that are most dynamic in a person's life. For example, as adolescent children mature and teeth transition from the primary to adult dentition, the level of the children's self-consciousness increases. For patients with limited and mild malocclusions, self-esteem is positively reinforced. For those with a perceived severe malocclusion, their self-esteem is more likely to be negatively affected. This rationale suggests that for patients with a perceived malocclusion, orthodontic treatment is more important and is best rendered at the time of dissatisfaction.

Professional findings

Smile aesthetics and straightness were positively correlated. In other words, when professionals rated the same subject they agreed on both smile aesthetics and straightness. Although a few raters were biased, the overall relationship between aesthetics and straightness was positive. In this study, there was a high level of agreement between raters, which can be explained by the training that occurred prior to the implementation of the professional survey. These findings suggest that either the calibration done prior to the rating was very successful or the raters were homogeneous in their perception of dental aesthetics and straightness no matter age, race, gender or education background. However, our results did show that age played a role, creating a significant difference when correlated with other raters. Rater "K" was one of the few practitioners participating in this study that had practiced for more than 2 decades and rated smile aesthetics and straightness lower than all other raters. Also, female raters had larger standard deviations when making their assessment. This suggested that female professionals

were less consistent when rating subjects of the same smile characteristics and that more factors influenced their perception of dental aesthetics and straightness than male raters. Interestingly enough, like previously mentioned, females were more likely to rate their own smiles more critically as well.

The professional raters agreed that an aesthetic smile was dependent on how straight the subjects teeth were. Orthodontists spend 2-3 years training to level and align the dentition perfectly to obtain the best aesthetic, functional, and stable result attainable. Although there are many facets that make up smile attractiveness, a very rudimentary relationship would most likely begin with straightness. Our findings indicated that this relationship existed and was indeed true. In general Orthodontists placed heavy emphasis on the level of straightness when considering smile attractiveness. Furthermore, in this study professionals were less likely to rate a subject as having an aesthetic smile if the teeth were crooked when compared with the subjects self-evaluation. This suggested that lay persons were interested in more factors than the straightness of teeth alone when considering smile aesthetics.

Professionals rated females as having a more aesthetic smile and straighter teeth than males, but no difference was found based on the gender of the rater. Our study did not seem to be in agreement with studies done previously, which showed the sex of the judge had a significant impact on aesthetic scores, where male judges rated females as more attractive than did female judges.⁵² The sex of the judge did not have a significant impact on esthetic scores and there was no difference between male raters and female raters.⁵² This was likely due to the unequal distribution of male and female raters in this study. This study consisted of 3 female and 10 male raters. Therefore, the majority of ratings were completed by males and female raters were under represented in this study, which might have skewed this finding.

Professionals gave higher ratings for smile aesthetics and straightness for subjects that previously had orthodontic treatment, but not self-esteem. There was no relationship between

professional ratings of smile aesthetics or straightness and self-esteem. These results suggest that orthodontists can not predict ones self-esteem by evaluating a patients smile aesthetics or straightness. This concept illustrates the importance of self-perception versus professional evaluation regarding smile aesthetics and straightness.

Relationships: Subjects and Professionals

This study uncovered an interesting and somewhat surprising relationship between subjects and professional raters (laypersons and orthodontists). There was a positive relationships between self-perception ratings and professional ratings of both smile aesthetics and straightness, suggesting that subjects can accurately diagnose the attractiveness and straightness of their own smile. These findings are in disagreement with the findings of Shaw et al, advocating that lay persons were frequently unable to recognize their own dental features.⁵³ Our findings agreed with more recent studies suggesting that laypersons can reliably identify smile characteristics, but their ranges of acceptability are large^{54, 55} and their opinions of their own smile is significantly higher than that of professionals.⁴¹ It is possible that subject ratings were more similar to professionals than seen in previous studies because of an increase in the accessibility of information. Many orthodontic supply companies and orthodontic practices spend more time marketing and implementing advertising campaigns to increase demand and a likely consequence is improving the general publics knowledge of dental aesthetics. It is likely that dental education will continue to increase in the future due to the increased marketing and the improvement of the public's dental IQ. The internet has made information more available to everyone and the general public is better able to self learn about dental topics.

Evidence in this study did not support a relationship between a professional's rating of straightness or attractiveness and a subjects self-esteem. In other words, professionals could not assess the level of self-concept a person had based on whether or not they had a straight or aesthetic smile. This emphasized the importance of determining how one perceives their own

smile and not how an orthodontist perceives an individual's smile. Results from Kenealy et al,⁷ showed that subjects that under-rated their own facial attractiveness had lower self-esteem scores than over-raters. Additionally, over-raters for dental attractiveness had higher self-esteem.⁷ Shaw found that little benefit from treatment would be expected if one already has a high self-esteem.⁷ In our population, the average person had a moderate to high self-esteem, which could explain why no difference in self-esteem was found between subjects that had received previous orthodontic treatment and those who did not. Similar to Shaw⁵³ in our study population, we would expect little benefit of orthodontic treatment if the subjects already had a high self-esteem. It is impossible for us to know what their self-esteem was prior to orthodontic treatment during adolescence and therefore this point makes it extremely difficult to identify a relationship between the two.

In summary, the findings of this study suggest that it is important to understand the intricacies of self-perception of smile aesthetics, because self-perception is a more important predictor of self-esteem than a person's actual smile aesthetics. Subjects with straight teeth perceived their smile as more aesthetic. Subjects that perceived themselves as having a more aesthetic smile had a higher self-esteem. Subjects that had orthodontic treatment in the past perceived their teeth were straighter and their smile was more aesthetic. There was no relationship between previous orthodontic therapy and self-esteem. Self-perception of smile aesthetics may be a more important aspect and a better predictor of self-esteem than a person's actual smile aesthetics. This study did not support the idea that orthodontic treatment unconditionally improves one's self-esteem, but it did not reject the existence of a potential relationship.

Further studies are needed on this topic to explore the relationship between self-esteem and previous orthodontic treatment. To improve this study a more diverse population would need to be sampled, i.e. non-university students in addition to university students of the same age, to

eliminate any biases that are inherent to the sampling of a university population with an enhanced self-esteem. It would be extremely beneficial to implement a longitudinal study starting in early adolescence and spanning until late adolescence to determine if differences between treated and non treated groups exist.

Conclusions

The following conclusions can be reached from this study.

Conclusions for the Subject Group

1. Generally, the subjects of this study felt positive about their smile and how straight their teeth were.
2. Females felt their teeth were straighter than males.
3. There was a positive correlation between smile aesthetics and smile straightness.
4. There was a positive correlation between self-perception of smile aesthetics and self-esteem, but not straightness and self-esteem.
5. African American subjects had a higher self-esteem than did other subjects.
6. Subjects that previously had orthodontic treatment gave a higher rating for their smile aesthetics and straightness, but not self-esteem.

Conclusions for the Professional Group

7. Professionals ratings of the same picture was high, and they agreed on both levels of smile aesthetics and straightness.
8. A positive correlation between smile aesthetics and straightness was found, and straightness was upperbound for smile aesthetics.
9. Professionals gave higher ratings for subjects that previously had orthodontic treatment for their smile aesthetics and straightness, but not self-esteem.
10. Professionals rated smile aesthetics and straightness higher for females than they did for males.
11. No relationship between professional ratings of smile aesthetics or straightness and self-esteem.

Conclusions for the Relationship existing between Existing between Subjects and Professionals

12. Positive relationships between self-perception of smile aesthetics of the subjects and professionals, although professional rated lower than subjects.
13. Positive relationships between self-perception of smile straightness of the subjects and professionals, although the professionals rated lower that subjects.
14. Both subjects and professional rated females as having straighter teeth.

Literature Cited

1. Baldwin, D. Appearance and aesthetics in oral health. *Community Dentistry and Oral Epidemiology*. 1980: 8: 244
2. Shaw, W. C., Rees, G., Dawe, M., & Charles, C. R. The influence of dentofacial appearance on the social attractiveness of young adults. *American Journal of Orthodontics*. 1985: 87(1): 21-26
3. Dion, K., & Walster, E. What is beautiful is good. *Journal of Personality and Social Psychology*. 1972: 24(3): 285
4. Blascovich, J. and Tomaka, J. (1991). Measures of self-esteem. In J.P. Robinson, P.R. Shaver, and L.S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes: Vol. 1. Measures of social psychological attitudes* (pp.115-160). San Diego, CA: Academic Press
5. Patzer, G.L. Improving self-esteem by improving physical attractiveness. *Journal of Esthetic Dentistry*. 1997; 9(1):44-6
6. Giddon, D.B. Orthodontic applications of psychological and perceptual studies of facial esthetics. *Seminars in Orthodontics*. 1995: 1(2): 82-93
7. Kenealy, P., Gleeson, K., Frude, N., and Shaw, W. The importance of the individual in the 'causal' relationship between attractiveness and self-esteem. *Journal of Community and Applied Social Psychology*. 1991: (1): 45-56
8. Adams, GR. Physical attractiveness research – toward a developmental social-psychology of beauty. *Human Development*. 1977: (20): 217-239
9. Feingold, A. Good-looking people are not what we think. *Psychological Bulletin*. 1992: 111(2): 304-341
10. Thornton, B. and Ryckman, R.M. Relationship between physical attractiveness, physical effectiveness, and self-esteem: A cross-sectional Analysis among adolescents. *Journal of Adolescence*. 1991: 14 (1): 85-98

11. Mathes, E.W. and Kahn, A. Physical attractiveness, happiness, neuroticism, and self-esteem. *Psychology*. 1975: (90): 27-30
12. Mueser, K.T., Grau, B.W., Sussman, S. and Rosen, A.J. You're only as pretty as you feel: Facial expression as a determinant of physical attractiveness. *Journal of Personality and Social Psychology*. 2007: 46: 469-478
13. Little, A.C., Burt, D.M. and Perrett, D.I. What is good is beautiful: Face preference reflects desired personality. *Personality and Individual Differences*. 2006: 41: 1107-1118
14. Thompson L, Malmberg J, Goodell N, Boring R. The distribution of attention across a talker's face. *Discourse Processes*. 2004: 38: 145–168.
15. Newton, J., Prabhu, N., & Robinson, P. The impact of dental appearance on the appraisal of personal characteristics. *The International Journal of Prosthodontics*. 2003: 16(4): 429
16. Hunt, O., Hepper, P., Johnston, C. and Stevenson, M. Professional perceptions of the benefits of orthodontic treatment. *European Journal of Orthodontics*. 2001: 23: 315-323
17. Gazit-Rappaprt, T., Haisraeli-Shalish, M. and Gazit, E. Psychological reward of orthodontic treatment in adult patients. *European Journal of Orthodontics*. 2010: 32: 441-446
18. Helm, S., Kreiborg, S. and Solow, B. Psychological implications of malocclusion: A 15-year follow-up study in 30-year-old Danes. *American Journal of Orthodontics*. 1985: 110-118
19. Paula, D.F., Silva, E.T., Campos, A.V., Nunez, M.O. and Leles, C.R. Effect of anterior teeth display during smiling on the self-perceived impacts of malocclusion in adolescents. *The Angle Orthodontist*. 2011: 81(3): 540-545
20. Badran, S.A. The effect of malocclusion and self-perceived aesthetics on the self-esteem of a sample of Jordanian adolescents. *European Journal of Orthodontics*. 2010: (32): 638-644
21. Richmond, S., Shaw W.C., O'Brien, K.D., Buchanan, I.B., Stephens, C.D., Andrews, M. and Roberts, C.T. The relationship between the index of orthodontic treatment need and consensus opinion of a panel of 74 dentists. *British Dental Journal*. 1995: 178(10): 370-374

22. Hunt, O., Hepper, P., Johnston, C. and Stevenson, M. Professional perceptions of the benefits of orthodontic treatment. *European Journal of Orthodontics*. 2001: 23: 315-323
23. Hamdan, A.M. The relationship between patient, parent and clinician perceived need and normative orthodontic treatment need. *European Journal of Orthodontics*. 2004: 26(3): 265-271
24. Van der Geld, P., Oosterveld, P., Van Heck, G. and Kuijpers-Jagtman, A. Smile Attractiveness. *The Angle Orthodontist*. 2007: 77(5): 759-765
25. Kenealy, P., Frude, N. and Shaw, W. An evaluation of the psychological and social effects of malocclusion – some implications for dental policy making. *Social Science and Medicine*. 1989: 28(6): 583-591
26. Mathes, E.W. and Khan, A. Physical attractiveness, happiness, neuroticism, and self-esteem. *The Journal of Psychology*. 1975: 90: 27-30
27. Birkeland, K., Boe, O.E., and Wisth, P.J. Relationship between occlusion and satisfaction with dental appearance in orthodontically treated and untreated groups. A longitudinal study. *European Journal of Orthodontics*. 2000: 22: 509-518
28. Korabik, K. Self-concept changes during orthodontic treatment. *Journal of Applied Social Psychology*. 1994: 24 (11): 1022-1034
29. Birkeland, K., Boe, O.E., and Wisth, P.J. Orthodontic concern among 11-year-old children and their parents compared with orthodontic treatment need assessed by Index of Orthodontic Treatment Need. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1996: 110(2): 197-205
30. Shaw, W.C., Richmond, S., Kenealy, P.M., Kingdon, A., and Worthington, H. A 20-year cohort study of health gain from orthodontic treatment: Psychological outcome. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2007: 132: 146-157
31. Tung, A. W., and Kiyak, H.A. Psychological influences on the timing of orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1998: 113: 29-39

32. Mandall, N.A., McCord, J.F., Blinkhorn, A.S., Worthington, H.V., and O'Brien, K.D. Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in Greater Manchester. *European Journal of Orthodontics*. 1999: 21: 175-183.
33. Rivera, S.M., Hatch, J.P., and Rugh, J.D. Psychological factors associated with orthodontic and orthognathic surgical treatment. *Seminars in Orthodontics*. 2000: 6(4): 259-269
34. Phillips, C., and Edwards Beal, K.N. Self-concept and the perception of facial appearance in children and adolescents seeking orthodontic treatment. *The Angle Orthodontist*. 2009:79: 12-16
35. Onyean, C.O. An assessment of relationship between self-esteem, orthodontic concern, and Dental Aesthetic Index (DAI) scores among secondary school students in Ibadan, Nigeria. *International Dentistry Journal*. 2003: 53(2): 79-83
36. Jung, M. Evaluation of the effects of malocclusion and orthodontic treatment on self-esteem in an adolescent population. 2010:138: 160-166
37. Cline M.E., Herman, J., Shaw E.R., and Morton, R.D. Standardization of the Visual Analogue Scale. *Nursing Research*. 1992: 41(8): 378-380
38. Howells, D.J., and Shaw W.C. The validity and reliability of ratings of dental and facial attractiveness for epidemiologic use. *American Journal of Orthodontics*. 1985: 88(5): 402-408
39. Flores-Mir, C., and Major, P.W. Self-perceived orthodontic treatment need evaluated through 3 scales in a university population. *Journal of Orthodontics*. 2004: 31: 329-334
40. Wolfart, S., Thormann, H., Freitag, S., and Kern, M. Assessment of dental appearance following changes in incisor proportions. *European Journal of Oral Science*. 2005: 113: 159-165
41. Jornung, J., and Fardal, O. Perceptions of patients' smiles, a comparison of patients' and dentists' opinions. *Journal of the American Dental Association*. 2007: 138(12): 1544-53

42. Parekh, S.M., Fields, H.W., Beck, M., and Rosenstiel, S. Attractiveness of variations in smile arc and buccal corridor space as judged by orthodontists and laymen. *The Angle Orthodontist*. 2006: 76: 557-563.
43. Vaida, L., Pirte, A., Corega, C., Slavescu, D., and Mutiu, G. Correlations between the changes in patients' dental-facial morphology at the end of the orthodontic treatment and the psychological variables. *Romanian Journal of Morphology and Embryology*. 2009: 50(4): 625-629
44. Crain, M.R., and Bracken, B.A. Age, race, and gender differences in child and adolescent self-concept: Evidence from a behavioral acquisition, context-dependent model. *School Psychology Review*. Psychology and Behavioral Sciences Collection. 1994: 23(3): 496
45. Klages, U., Bruckner, A., and Zentner, A. Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *European Journal of Orthodontics*. 2004: 26: 507-514
46. Bernabe, E., Kresevic, V.D., Cabrejos, S.C., Flores-Mir, F., and Flores-Mir, C. Dental esthetic self-perception in young adults with and without previous orthodontic treatment. *The Angle Orthodontist*. 2006: 76: 412-416
47. Gaus, V., Wood, J. V., Beech, M. G., Taylor, K. L., & Michela, J. L. Strategies of social comparison among people with low self-esteem: Self-protection and self-enhancement. *Journal of Personality and Social Psychology*. 1994: 67: 713-731.
48. Frost, J. and McKelvie, S. Self-esteem and body satisfaction in male and female elementary school, high school and university students. *Sex Roles*. 2004: 51: 45-54
49. Geron, S., and Atalia, W. Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. *The Angle Orthodontist*. 2005: 75: 778-784
50. Rodrigues, C., Magnani, R., Machado, M., Oliveira, O., The perception of smile attractiveness. *The Angle Orthodontist*. 2009: 79: 634-639

51. Varela, M., and Garcia-Camba, J.E. Impact of orthodontics on the psychological profile of adult patients: A prospective study. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1995: 108:142-148
52. Anderson, K.M., Behrents, R.G., McKinney, T., and Buschang, P.H. Tooth shape preferences in an esthetic smile. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2005: 128(4): 458-465
53. Shaw, W.C. Factors influencing the desire for orthodontic treatment. *European Journal of Orthodontics*. 1981: 3(3): 151-162
54. Ker, A.J., Chan, R., Fields, H.W., Beck, M., and Rosenstiel, S. Esthetics and smile characteristics from the laypersons' perspective. A computer-based survey study. *Journal of American Dental Association*. 2008: 139(10): 1318-1327
55. Elham, S.J., Alhaija, J.A., Al-Shamsi, N. O., and Al-Khateeb, S. Perceptions of Jordian laypersons and dental professional to altered smile aesthetics. *European Journal of Orthodontics*. 2010: 1 of 7

Appendix 1

RESEARCH SUBJECT INFORMATION AND CONSENT FORM

TITLE: Self-perception of Smile Aesthetics and Self-esteem Using A VAS

VCU IRB NO.: HM12754

Investigator: Larry D. Scarborough, Jr., D.D.S., Bhavna Shroff, D.D.S., M.D.Sc., M.P.A.

This consent form may contain words that you do not understand. Please ask the study staff to explain any words that you do not clearly understand. You may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

PURPOSE OF THE STUDY

The purpose of this study is to determine if there is a relationship between how one perceives their smile attractiveness and their self-esteem.

DESCRIPTION OF THE STUDY

If you decide to participate in this research study, you will be asked to sign this consent form after you have had all your questions answered and understand how you will be participating. A photograph of your smile showing only your teeth and lips will be taken and you will evaluate your smile attractiveness. You will also be asked to answer a series of questions about your smile. The photograph will be placed on a secure, password-protected database through Virginia Commonwealth University. The photograph will be viewed by 10 dental providers who will be asked to answer one question in reference to your smile photograph. A questionnaire focusing on how you feel about your smile attractiveness and your self-esteem will be administered. The questionnaire will take 5 minutes of your time. A photograph of your smile may be used for publication purposes in a scientific journal. The research study is expected to last approximately 12 months.

RISKS AND DISCOMFORT

For the purpose of this study a photograph of your smile will be taken, and therefore, it would be extremely difficult for someone to identify you based on this photograph. This picture will be evaluated by dental providers on a secure database, who may know you.

BENEFITS TO YOU AND OTHERS

You may not get any benefit from this study, but, the information we learn from this research study will help the orthodontic community better appreciate the benefit of orthodontic treatment.

COSTS

There are no costs for participating in this study.

PAYMENT FOR PARTICIPATION

As compensation for your participation, you will receive a five dollar gift.

ALTERNATIVES

You may decline the release of your photograph for the purpose of this study and thereby NOT participate in this study.

CONFIDENTIALITY

Potentially identifiable information about you will consist of a frontal photograph of your smile. No identifier will link the photograph to you so the data will not be identifiable. Data will be collected only for research purposes. The data will be stored at the Virginia Commonwealth University in a lock cabinet on the Medical College of Virginia Campus and only accessible to the investigators. This consent form will be kept in a locked file cabinet for approximately 1 year after the study ends and will be destroyed at that time. Access to all data will be limited to study personnel.

What we find from this study may be presented at meetings or published in papers, but your name will never be used in these presentations or papers.

IF AN INJURY HAPPENS

There is no risk of injury from the release of the photograph taken of your smile for the purpose of this research study.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

Your involvement in this study is completely voluntary. You do not have to participate in this study. After reviewing this consent form, if you feel that all your questions have been adequately addressed and answered, you may still decide to NOT participate in this study.

You have the right to withdraw from the study at any time. Your participation in this study may be stopped at any time by the study staff or the investigator without your consent. The reasons might include:

- the study staff thinks it is necessary for your health or safety
- the investigator has stopped the study
- administrative reasons require your withdrawal

QUESTIONS

In the future, you may have questions about your participation in this study. If you have any questions, complaints, or concerns about the research, contact:

Dr. Larry D. Scarborough, Jr.
VCU Department of Orthodontics
512 N. 12th St.
Richmond, VA 23298
scarborougl@vcu.edu
804.828.0843

If you have any questions about your rights as a participant in this study, you may contact:

Office for Research
Virginia Commonwealth University
800 East Leigh Street, Suite 113

**P.O. Box 980568
 Richmond, VA 23298
 Telephone: 804-827-2157**

You may also contact this number for general questions, concerns or complaints about the research. Please call this number if you cannot reach the research team or wish to talk to someone else. Additional information about participation in research studies can be found at <http://www.research.vcu.edu/irb/volunteers.htm>.

CONSENT

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about the study have been answered. My signature says that I am willing to participate in this study.

Participant name printed

Participant signature

Date

Name of Person Conducting Informed Consent

Discussion / Witness

Signature of Person Conducting Informed Consent



Date

Discussion / Witness

Investigator signature (if different from above)

Date

Appendix 2

 <p>VCU School of Dentistry</p>	<p>Survey Type: _____ Questionnaire # _____</p>
	 <p>Self-perception of Smile Aesthetics</p> <p>A SURVEY</p> <p>This survey will take less than 5 minutes!</p> <p>This survey is part of a research project sponsored by the Virginia Commonwealth University Department of Orthodontics to study the self-perception of smile aesthetics and self-esteem.</p> <p>The title of the study is:</p> <p><i>Self-perception of Smile Aesthetics and Self-esteem</i></p> <p>The purpose of this study is to determine if there is a relationship between how one perceives their smile attractiveness and their self-esteem.</p> <p>Please do not put your name on the survey so that your answers remain anonymous, and return it to your course director or to the individual that distributed it.</p> <p>If you have any questions about the survey, you may contact the Virginia Commonwealth University Department of Orthodontics at 804-828-0843.</p>

Section 11) Male Female

2) Age: _____

3) Race: Please Circle One

African American Asian Caucasian Hispanic

Other: _____

4) Profession/Major: _____

5) How do you feel about your smile?

Please mark along this line indicating how satisfied you are with your smile.

Not Satisfied Very Satisfied

6) Do you feel your teeth are straight? Yes No

Please mark along this line indicating how straight or crooked you feel your teeth are.

Very Crooked Very Straight

7) Have you had orthodontic treatment (braces)? Yes No

8) Are you interested in having orthodontic treatment (braces)?

Yes No

Please mark along this line indicating how interested you are in having orthodontic treatment (braces).

Not Interested Very Interested

Section 2

Please circle the best answer to the following questions:

SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

1) On the whole, I am satisfied with myself.

SA A D SD

2) At times, I think I am no good at all.

SA A D SD

3) I feel that I have a number of good qualities.

SA A D SD

4) I am able to do things as well as most other people.

SA A D SD

5) I feel I do not have much to be proud of.

SA A D SD

6) I certainly feel useless at times.

SA A D SD

7) I feel that I'm a person of worth, at least on an equal plane with others.

SA A D SD

8) I wish I could have more respect for myself.

SA A D SD

9) All in all, I am inclined to feel that I am a failure.


SA A D SD

10) I take a positive attitude toward myself.

SA A D SD

Appendix 3

Survey Type: Dental Provider Questionnaire # _____



VCU School of Dentistry

1) Please slide the cursor along this line to indicate how straight or crooked you feel these teeth are.

|-----|

Very Crooked Very Straight

2) Please slide the cursor along this line to indicate how attractive you feel this smile is.

|-----|

Not Attractive Very Attractive

Thank you for your participation.

Page 1 of 1

CURRICULUM VITA

Larry D. Scarborough, Jr. was born on November 05, 1977, in Washington, D.C., and is an American citizen. He graduated from Centreville High School, in Centreville, Virginia in 1996. He received his Bachelor of Science in Fisheries Science from Virginia Tech, Blacksburg, Virginia in 2002 and subsequently attended Virginia Commonwealth University School of Dentistry graduating Summa Cum Laude in 2009.

Larry D. Scarborough, Jr., D.D.S.

EDUCATION

Virginia Commonwealth University (VCU), School of Dentistry, Department of Orthodontics, Richmond, VA

Certificate in Orthodontics, M.S.D., 06/2011

Virginia Commonwealth University (VCU), School of Dentistry, Richmond, VA

D.D.S., *summa cum laude*, 05/2009

Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, VA

B.S., Fisheries Science, *cum laude*, 12/2002

LEADERSHIP EXPERIENCE

Student Alumni Ambassador, VCU School of Dentistry, 2005-2009

Dental Admissions Committee, VCU School of Dentistry, Class of 2013, Voting Member, 2008-2009

Virginia Dental Association (VDA), Dental Practice Regulations Committee (1 Year Term), 01/2008-01/2009

American Student Dental Association (ASDA) Representative, 2007-2008

Virginia Dental Association (VDA), Annual Governance Meeting, 36th House of Delegates, Voting Member, 2007

President, Class of 2009, VCU School of Dentistry, 2006-2007

Curriculum Committee, VCU School of Dentistry, 2005-2006

HONORS AND AWARDS

Charley Schultz Resident Scholar Award: Selected Participant: Self-Perception of Smile Aesthetics and Self-Esteem, 2011

Alexander Fellowship Award, Masters Thesis: Self-Perception of Smile Aesthetics and Self-Esteem, 2010

Southern Association of Orthodontists (SAO) Fellowship Grant, Masters Thesis: Self-Perception of Smile Aesthetics and Self-Esteem, 2010

Omicron Kappa Upsilon National Dental Honor Society (OKU), 2009- Present

The American Equilibration Society Award, Outstanding Performance in the Science of Dental Occlusion and TMJ Function, VCU School of Dentistry, 2009

Oral Biology Award, The American Association of Oral Biologists, For Significant Achievement and Contribution to Oral Science, 2009

School of Dentistry Scholarship, VCU School of Dentistry, 2008-2009

Dean's List, VCU School of Dentistry, 2005-2009

Commendation, VCU School of Dentistry, Department of General Practice, 2008

Commonwealth Award Dentistry, Merit Scholarship, Virginia Commonwealth University (VCU) Foundation, School of Dentistry, 2006-2007 and 2007-2008

Pierre Fauchard Academy, Annual Scholarship Award for Outstanding Leadership and Academic Achievement in Dentistry, 2007

Outstanding Organization Award: Class President, Student Governance

Committee/American Student Dental Association (SGC/ASDA), VCU School of Dentistry, 2007

A.D. Williams Research Fellowship, 2007

Orthodontic Service Award, For Outstanding Dedication and Service, VCU School of Dentistry, Department of Orthodontics, 2003-2005

Golden Key International Honour Society, 2002-Present

Julian N. Cheatham Scholarship Award, Virginia Tech, College of Natural Resources, 2002

American Fisheries Society Chapter of the Year Award, Virginia Tech Chapter, 2002

RESEARCH EXPERIENCE

Self-perception of Smile Aesthetics and Self-esteem

Principal Advisor: Dr. Bhavna Shroff, Department of Orthodontics, Present

- Master Thesis, Defense in May of 2011

CSF-1 and ODF Expression During Tooth Eruption in Mice

Principal Advisor: Dr. Bhavna Shroff, VCU, Department of Orthodontics, 2008

- Presented at the American Association for Dental Research (AADR) and at the Conference on Orthodontic Advances in Science and Technology (COAST), 2008
- Published in the Conference Abstracts of the 4th Biennial COAST Symposium Biomedicine in Orthodontics: From Tooth Movement to Facial Growth

Quantifying Biomaterial Cytocompatibility via In-Cell Assay of Phosphovinculin

Principal Advisor: Dr. Matthew J. Beckmann, VCU, Department of Biochemistry, 2007

- Conducted tissue culture of MG-63 osteoblast like cells

Effects of Recombinant Bovine Growth Hormone on Juvenile Rainbow Trout (*Oncorhynchus mykiss*) Maintained in a Recirculating System

Principal Advisor: Dr. Ewen McLean, Virginia Tech, Department of Fisheries, 2002

- Published in the Proceedings of the 4th International Conference on Recirculating Aquaculture, 2002

Diel Pattern of Invertebrate Drift Above and Below a Stream Impoundment

Principal Advisor: Dr. Simmons, Virginia Tech, Department of Biology, 2002

- Presented at the Virginia Tech 2002 Freshwater Symposium

TEACHING EXPERIENCE

Pre-Clinical Orthodontics, VCU School of Dentistry, Orthodontic Resident, 2009

Dental Anatomy, VCU School of Dentistry, Teaching Assistant, 2008

Occlusion, VCU School of Dentistry, Teaching Assistant, 2008

Dental Photography, VCU School of Dentistry, CE Course, Teaching Assistant, 2007

4-H DAY, Virginia Tech, Water Wizard Volunteer, 2002
