Psychosocial impact of anterior dental esthetics on periodontal health, dental caries, and oral hygiene practices in young adults

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This study sought to determine whether the self-perceived image of a young adult’s anterior dental esthetics is linked to periodontal health, dental caries, and oral hygiene practices. Two hundred subjects were assessed via a clinical examination, including intraoral photographs. The subjects were questioned about their demographics and oral hygiene practices and given the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) to measure their self-perceived variables related to dental esthetics. A high PDAQ score indicates a negative image of one’s own dental esthetics, while a low PDAQ score indicates a positive outlook. A self-perceived negative psychosocial impact of anterior dental esthetics was detected in subjects with higher levels of dental caries and visible gingival inflammation in the anterior region of the mouth.

Key words: dental esthetics, oral health, psychosocial, young adults

Ac cording to a 2011 report from the US Department of Health and Human Services Centers for Disease Control and Prevention, caries affects 1 in 2 US adolescents aged 12-15 years, and most US adults show signs of periodontal disease.¹ It is surprising that oral disease is so widespread in the United States as the keys to prevention—straighter teeth.¹⁴ It has also been found that subjects with a more favorable self-concept and former orthodontic patients have more frequent dental visits and better oral hygiene practices.⁷,¹⁵ Additional studies have shown, via changes in patients’ PDAQ scores over time, an improvement of subjects’ self-assessment of their anterior dental esthetics over the course of treatment procedures such as orthodontics and/or implantation of anterior teeth.¹⁶,¹⁷ These studies focused only on specific characteristics typically associated with anesthetic smile—such as alignment, malocclusion, or the mere presence of anterior teeth—while other clinical variables such as tooth shade and shape, existing restorations, or any other esthetically displeasing conditions probably play a significant role in the PDAQ assessment. In addition, most of these previous studies were based on the patients’ self-perception of dental esthetics without comparison to the more objective rating of a clinician.

The aim of this study was to determine if individuals who self-report a psychosocial impact from their overall dental esthetics tend to have poorer reported oral hygiene practices and therefore poorer periodontal health and a higher prevalence of caries in the anterior sextants.

Materials and methods

This cross-sectional study was conducted in a group of 200 overall healthy active duty military personnel at the 87th Dental Squadron, Joint Base McGuire-Dix-Lakehurst, New Jersey. The study was conducted from March 2013 through May 2013, and the participants were subjects who were being seen for their annual dental examination or for their yearly dental cleaning. The human rights of the subjects were protected, and approval was obtained from the institutional review board of the 59th Clinical Research Division.

After each participant gave informed consent, an intraoral photograph was taken with a FinePix S3Pro digital camera (Fujifilm Corporation) with a Sigma EM-140 DG intraoral flash (Sigma Corporation of America). For the photograph, the patient was asked to swallow and occlude on his or her posterior teeth while smiling. Each subject was given a self-administered Patient Questionnaire (PQ) that was developed expressly for this study (Fig 1). The PQ included the...
PIDAQ as a subsection. At each clinical examination, calibrated general dentists filled out a Dentofacial Anomalies and Oral Health Assessment (DAOHA) form that recorded the periodontal health assessment of each patient (Fig 2). The dentists also filled out a decayed, missing, and filled surfaces (DMFS) index for each subject.

The PIDAQ is a 23-item psychometric instrument for assessing orthodontic-specific impacts of dental esthetics. The other components of the PQ included questions about oral hygiene practices, self-rating of dental esthetics, and other demographics. The 2 primary dependent variables, the periodontal health assessment and dental caries (DMFS index), were only collected from the 12 anterior teeth and recorded on the DAOHA form. Visible gingival inflammation (VGI), bleeding on probing, gingival calculus, presence of gingival probing depths greater than 3 mm, and dental caries were measured by the dentist, who used a manual periodontal probe with a 3-mm marking, a dental mirror, an explorer, and the overhead light of the dental chair.

The averaged panel esthetic ratings were obtained from a panel composed of 3 general dentists who rated the overall esthetics of each subject's anterior teeth from the intraoral photographs presented via a PowerPoint presentation for 30 seconds. The smiles were rated using a nonnumerical scoring system: in the top 1%; in the top 10%; above average; average; below average; in the bottom 10%; or in the bottom 1%.

Primary data analysis consisted of a comparison of those subjects who scored in the upper tercile on the PIDAQ (subjects who self-reported a significant psychosocial impact from the dental esthetics of their anterior teeth) to the subjects who scored in the lower tercile on the PIDAQ (subjects who did not self-report a significant psychosocial impact from the dental esthetics of their anterior teeth). Chi-square testing was used for statistical analysis.

## Results

Of 240 potential subjects who were approached, 83.3% (n = 200) participated by completing all questionnaires and undergoing a complete oral examination. The 16.7% (n = 40) subjects who declined did so mostly due to time restrictions. The mean age of the sample was 30.2 (SD, 7.5) years, and the range was 18-50 years. Among the participants, 20.5% (n = 41) were women, and 79.5% (n = 159) were men. The mean overall PIDAQ score was 21.7 (SD, 16.5); scores ranged from 0 to 89.

The mean DMFS scores for the 12 anterior teeth in subjects in the upper PIDAQ tercile were 6.4 times those recorded for subjects in the lower tercile, a statistically significant difference ($P < 0.000$; Table 1). The total VGI score (the sum of the buccal and lingual VGI scores) for subjects in the upper PIDAQ tercile was 1.5 times that reported for subjects in the lower tercile ($P = 0.004$). The buccal VGI ($P = 0.007$) and lingual VGI ($P < 0.006$) were also significantly different in the upper and lower PIDAQ terciles.

### Table 1. Comparison of mean (SD) scores for oral diseases or conditions among subjects in the lowest (n = 70) and highest (n = 66) PIDAQ terciles.

<table>
<thead>
<tr>
<th>Score</th>
<th>Lowest tercile</th>
<th>Highest tercile</th>
<th>$P$ value$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMFS</td>
<td>0.21 (0.90)</td>
<td>1.35 (3.00)</td>
<td>$&lt;0.000$</td>
</tr>
<tr>
<td>BVGI</td>
<td>3.77 (3.88)</td>
<td>5.45 (3.90)</td>
<td>$&lt;0.007$</td>
</tr>
<tr>
<td>LVGI</td>
<td>2.49 (2.88)</td>
<td>4.02 (3.37)</td>
<td>$&lt;0.006$</td>
</tr>
<tr>
<td>TVGI</td>
<td>6.33 (6.01)</td>
<td>9.50 (6.66)</td>
<td>$&lt;0.004$</td>
</tr>
</tbody>
</table>

Abbreviations: BVGI, buccal visible gingival inflammation; DMFS, decayed, missing, and filled surfaces; LVGI, lingual visible gingival inflammation; PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; TVGI, total visible gingival inflammation (BVGI plus LVGI).

$^a$Chi-square test.

### Table 2. Distribution of esthetic ratings (%) from investigators, averaged panel, and subjects among subjects in the lowest (n = 70) and highest (n = 66) PIDAQ terciles.$^a$

<table>
<thead>
<tr>
<th>Esthetic rating</th>
<th>Investigator</th>
<th>Averaged panel</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest tercile</td>
<td>Highest tercile</td>
<td>Lowest tercile</td>
</tr>
<tr>
<td>Top 1%</td>
<td>4.3</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Top 10%</td>
<td>31.4</td>
<td>6.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Above avg</td>
<td>35.7</td>
<td>13.6</td>
<td>24.3</td>
</tr>
<tr>
<td>Avg</td>
<td>10.0</td>
<td>15.2</td>
<td>42.9</td>
</tr>
<tr>
<td>Below avg</td>
<td>14.3</td>
<td>28.8</td>
<td>24.3</td>
</tr>
<tr>
<td>Bottom 10%</td>
<td>2.9</td>
<td>18.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Bottom 1%</td>
<td>1.4</td>
<td>16.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Abbreviations: Avg, average; NA, not applicable (category was not given to subjects, as it was deemed to be too difficult to categorize oneself in either extreme); PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire.

$^a$Chi-square test.
Thank you for participating in our dental health survey. All information will stay 100% confidential and totally anonymous. We are interested in your oral hygiene practices and how you perceive the way your teeth look. (For the next questions, please check ONE best answer)

1. How would you rate your current daily oral hygiene practices?
   - Excellent
   - Good
   - Fair
   - Poor
   - I refuse to answer

2. How often do you brush your teeth?
   - I brush more than twice a day
   - I brush twice a day
   - I brush once a day
   - I brush every other day
   - I never brush
   - Other. Please specify:___________________________
   - I refuse to answer

3. What kind of toothpaste do you use?
   - Fluoridated toothpaste
   - Nonfluoridated toothpaste
   - I don’t know if my toothpaste is fluoridated, but the brand that I usually use is: __________________________
   - I do not use toothpaste, just water
   - I do not use toothpaste, just mouthwash
   - Other. Please specify:______________________________________
   - I refuse to answer

4. How often do you floss?
   - I floss more than twice a day
   - I floss twice a day
   - I floss every other day
   - I floss once a week
   - I floss once a day
   - I floss twice a day
   - I floss more than twice a day
   - Other. Please specify:___________________________
   - I refuse to answer

5. When did you start flossing your teeth regularly?
   - Before age 6
   - Between ages 6 and 13
   - Between ages 14 and 19
   - After age 19
   - Other. Please specify:____________ years ago
   - I haven’t started to floss yet
   - I refuse to answer

6. On days that you don’t brush your teeth, what are your reasons for not brushing? (Check all that are applicable.)
   - I find brushing too time consuming/I am too lazy/I am too tired
   - I refuse to brush
   - I have a substitute for toothbrushing. Please specify: __________________________
   - I find brushing useless
   - I don’t have money for brush or toothpaste
   - I don’t like the way my teeth look and so I don’t brush them
   - Other. Please specify:______________________________________
   - I refuse to answer

7. On days that you don’t floss, what are your reasons for not flossing? (Check all that are applicable)
   - I find flossing too time consuming/I am too lazy/I am too tired
   - I refuse to floss
   - I floss twice a day
   - I floss every other day
   - I floss once a week
   - I floss once a day
   - I floss twice a day
   - I floss more than twice a day
   - Other. Please specify:______________________________________
   - I refuse to answer

8. How would you rate the overall “looks” or esthetics of your teeth as compared to other people you have seen? (Please choose ONE best answer)
   - In the top 10%
   - Above average
   - In the bottom 10%
   - I refuse to answer

9. Is there anything about the way your overall teeth look that you would like to change?
   - Yes
   - No
   - If you answered YES, please explain: __________________________

10. Do you think the way your teeth look has an effect on your self-esteem?
    - Yes
    - No

11. How satisfied are you with the overall color of your teeth? (Please choose ONE best answer)
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Dissatisfied
    - Very dissatisfied
    - I refuse to answer

12. How satisfied are you with the way your overall teeth are positioned/aligned? (Please choose ONE best answer)
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Dissatisfied
    - Very dissatisfied
    - I refuse to answer

13. Dental esthetic questionnaire* (Please circle ONE best answer for each statement)

<table>
<thead>
<tr>
<th>I am proud of my teeth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>I like to show my teeth when I smile.</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>I am pleased when I see my teeth in the mirror.</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Not at all</td>
</tr>
</tbody>
</table>

For all 3 esthetic ratings (the investigator’s esthetic ratings, the averaged panel esthetic rating, and the self-reported esthetic rating) statistically significant ($P < 0.000$) inverse associations were observed between subjects in the upper and the lower PIDAQ terciles; that is, higher esthetic ratings were given to subjects in the lower PIDAQ tercile for all 3 types of esthetic rating (Table 2). On the other hand, no statistically significant differences were found between subjects in the upper and lower PIDAQ terciles for the variables of sex, age, bleeding on probing, gingival calculus, or periodontal probing depths greater than 3 mm. Similarly, a statistically significant ($P < 0.000$) inverse relationship was detected between the self-reported
<table>
<thead>
<tr>
<th>My teeth are attractive to others.</th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>Strongly</th>
<th>Very strongly</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I am satisfied with the appearance of my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I find my tooth position to be very nice.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I hold myself back when I smile so my teeth don’t show as much.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>If I don’t know people well, I am sometimes concerned about how they think about my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I’m afraid other people could make offensive remarks about my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I am somewhat inhibited in social contacts because of my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I sometimes catch myself holding my hand in front of my mouth to hide my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>Sometimes I think people are staring at my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>Remarks about my teeth irritate me even when they are meant jokingly.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I sometimes worry what members of the opposite sex think about my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I envy the nice teeth of other people.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I am somewhat distressed when I see other people’s teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>Sometimes I am somewhat unhappy about the appearance of my teeth.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I think most people I know have nicer teeth than I do.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I feel bad when I think about what my teeth look like.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I wish my teeth looked better.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I don’t like the way my teeth look in the mirror.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I don’t like to see my teeth in photographs.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
<tr>
<td>I don’t like to see my teeth when I look at a video of myself.</td>
<td>Not at all</td>
<td>A little</td>
<td>Somewhat</td>
<td>Strongly</td>
<td>Very strongly</td>
<td></td>
</tr>
</tbody>
</table>

14. If your teeth were perfectly straight/bright, would you take better care of them (brush or floss more)?
- Definitely
- Probably
- No difference
- Probably not
- Definitely not
- I am not sure either way
- I refuse to answer

15. Have you ever received orthodontic treatment such as braces, bands, or removable appliances to straighten teeth?
- Yes as a child or as an adult (Please circle) No

16. What is your sex?
- Male
- Female

17. In what year were you born? 

18. What is your military branch? 

19. What is your marital status?
- Now married
- Widowed
- Divorced
- Separated
- Never married
- I refuse to answer

20. What is your current rank?
- Enlisted
- Officer
- Enlisted
- Officer

21. What is the highest degree or level of school you have completed? If currently enrolled, mark the previous grade or highest degree received.
- Less than 12th grade
- 12th grade, no diploma
- High school graduate—high school diploma or the equivalent (for example GED)
- Some college credit, but less than 1 year
- 1 or more years of college, no degree
- Associate’s degree (for example: AA, AS)
- Bachelor’s degree (for example: BA, AB, BS)
- Master’s degree (for example: MA, MS, MEng, MBA)
- Professional degree (for example: MD, DDS, DVM, LLB, JD)
- Doctorate degree (for example: PhD, EdD)
- I refuse to answer

22. Please specify your ethnicity
- Hispanic or Latino
- Not Hispanic or Latino
- I refuse to answer

23. Please specify your race
- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or Other Pacific Islander
- White
- I refuse to answer

you would like to change?” and “How satisfied are you with the overall color of your teeth?” and “How satisfied are you with the way your overall teeth are positioned/aligned?" they tended to be more critical of their teeth ($P < 0.000$) than did subjects in the lower PIDAQ tercile. When asked, “If your teeth were perfectly straight/bright, would you take better care of them (brush or floss more)?” subjects in the upper PIDAQ tercile were more likely to report that they would take better care of their teeth than were subjects in the lower tercile ($P = 0.013$).

No differences in PIDAQ by either sex or age were noted.

**Discussion**

This study of a sample of young adults in military service clearly demonstrated detectable differences in self-reported image of anterior dental esthetics (as measured by the PIDAQ scale in a comparison of upper vs lower tercile PIDAQ subjects) for the most visible of dental diseases, treatments, and conditions in the anterior portion of their mouths, while they demonstrated no such differences for less visible dental diseases, treatments, and conditions. Specifically, the highly visible presence of dental caries and restorations in the anterior segment as well as VGI was inversely associated with both a subject’s PIDAQ score—subjects with these highly visible dental conditions held markedly lower esthetic dental scores, indicating a lower esthetic dental self-image—and the quality of self-reported oral hygiene practices. Not only did these subjects report that they “looked worse,” but they also reported that they took “worse care” of their mouths. However, for the less visible dental conditions of calculus presence, periodontal pocket formation, and bleeding on probing, no such differences in dental image were detected in comparisons of the top and bottom PIDAQ tercile groups.

Similar findings were reported in a study on young adults who self-reported frequency of gingival bleeding and caries treatment.$^{15}$ In addition, the magnitude of the caries difference between the highest PIDAQ subjects and the lowest PIDAQ subjects was quite marked in the present study, as individuals in the highest PIDAQ tercile were 6.4 times more likely to have caries in the anterior sextants than those in the lowest tercile.

The fact that no association was found between PIDAQ scores and presence of either calculus or periodontal probing depths greater than 3 mm is perplexing, since these conditions should be improved by the better oral hygiene that was reported by the subjects in the lower PIDAQ tercile. One explanation might be the relatively small percentage of subjects in this study who reported flossing; most patients just used a toothbrush, which would correlate with less visible gingival inflammation but not necessarily with shallower periodontal probing depths or less calculus.
The unbalanced sex distribution of the sample (79.5% male), while not unanticipated in a sample of military recruits, is a potential limitation of this study. However, no significant differences in the findings were noted between the sexes, suggesting that the sample composition did not affect the results.

The PIDAQ scores were aligned with subjects’ responses to a separate set of direct questions in which they rated their own dental appearance. Subjects with lower PIDAQ scores had better self-esthetic ratings on these separate questions than did their counterparts with higher PIDAQ scores. These results parallel the findings in a study of adolescents.13

To make the ratings in this present study as objective as possible, 3 esthetic ratings were compared: an individual investigator’s esthetic rating, recorded while the patient was seated in the treatment chair; an averaged panel esthetic rating, recorded from an intraoral photograph of the subject’s smile; and a self-reported esthetic rating. The overall ratings followed the same trend, suggesting that the subjects’ self-rating confirmed the professionals’ findings. The results of this study suggest that subjects with highly favorable dental esthetics generally viewed their dentition as such and therefore were more inclined to maintain it through a rigorous oral hygiene regimen; subjects with less favorable dental esthetics (as both self-rated and confirmed by a panel of dentists) seemed to need more motivation to brush regularly.

As was suggested in previous studies on oral health attitudes, individuals with high-ranking dental esthetics may attribute their favorable dental arrangement to their efforts in prevention, which in turn might strengthen their resolve to take further favorable preventive measures.15 It was interesting to note that when subjects were asked what they could change in their smiles, the most frequent wishes were whiter and/or brighter teeth and straighter and/or less crowded teeth. When this US sample is compared to a population in Nigeria (where many people, even among the socioeconomic elite, do not appreciate the need for dental or orthodontic treatment), the US subjects seem to be critical of themselves while at the same time well aware of the methods available to improve a smile.10

The results of the present study seem to be in agreement with those of other studies reporting that young adults with less favorable dental esthetics exhibit less frequent dental cleaning behavior or—stated conversely—that self-esteem is positively correlated with toothbrushing frequency.7,16 Although subjects with higher PIDAQ scores attributed their own poor oral hygiene to the fact that their teeth needed esthetic improvement, the design of the present study only provides evidence of an association between the 2 factors; it does not permit the establishment of...
a causal relationship between a subject’s PIDAQ score and oral hygiene. Given that the subjects in this study with higher PIDAQ scores reported that they would take better care of their teeth if their teeth were perfectly bright and/or straight, this suggests a testable hypothesis in future studies. Additional research, which would study the oral hygiene behavior before and after improvement of the patient’s dental esthetics in collaboration with the patient’s wishes, would be necessary to establish the presence of a causal relationship.

Long-range clinical implications of the findings from this study include future investigations into educating parents about the importance of a beautiful, healthy smile for their children. An esthetic smile could limit or eliminate any potential negative psychosocial impact of unesthetic dental conditions on those children, positively impact their future adult self-image of anterior dental esthetics, and encourage them to practice better oral hygiene. Clearly, this proposed series of events would need verification, including results from clinical trials.

An immediate (and short-term) clinical implication for the clinician treating the esthetically dissatisfied adult patient is to listen to the patient’s esthetic desires (namely whiter and straighter teeth) and involve the patient more in clinical decisions. If the patient perceives current dental conditions as undesirable, he or she may be discouraged from actively participating in oral hygiene procedures.

Conclusion

Patients with a high negative impact from anterior dental esthetics are at a higher risk of neglecting their oral hygiene in the anterior area.

Author information

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