Dental esthetics, orthodontic treatment, and oral-health attitudes in young adults

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Introduction: The aim of this study was to investigate whether young adults with varying dental esthetics and histories of orthodontic treatment also differ in oral-health attitudes, preventive behaviors, and self-perceived oral health. Methods: The sample comprised 298 young adults, 18 to 30 years old, with at least 13 years of primary and secondary school education. The subjects were asked to complete questionnaires dealing with various measures related to oral-health attitudes, preventive behaviors, and perceptions of oral health. Dental esthetics were assessed by means of the aesthetic component of the index of orthodontic treatment need. Dental plaque accumulation was assessed in a subsample of respondents. Results: Subjects with high dental-esthetics scores reported more favorable oral-health attitudes, such as internal control, dental awareness, value of occlusion, and preventive behavior expectations than subjects with lower scores. Subjects with previous orthodontic treatment showed greater internal control and dental awareness than those who had not previously been treated. Subjects ranking high in dental esthetics and those with previous orthodontic treatment reported stricter oral-hygiene adherence than others. Self-perceived oral health was better in high scorers on dental esthetics. Less plaque accumulation was found in subjects with higher dental esthetic scores and in those with previous orthodontic treatment. Conclusions: These findings suggest that favorable dental esthetics and previous orthodontic treatment might be important variables in explaining individual differences in oral-health attitudes and behaviors. (Am J Orthod Dentofacial Orthop 2005;128: 442-9)

Psychosocial research of the significance of physical attractiveness suggests that there is a perceived association between beauty and health.1 Satisfaction with one’s appearance is related to social functioning.2 Because malocclusion is often conspicuous, it might lead to adverse social reactions and a deficient self-concept. Occlusal corrections have been shown to improve body image of dental and facial features.3 Physically attractive persons tend to make more efforts to enhance their appearance by having, for instance, stronger interest in clothing than unattractive persons.4 Attractiveness has also been shown to correlate with exercise and physical fitness,5-7 and physically attractive persons tend to exhibit distinct health behavior patterns.5 People with highly esthetic dental appearances might strive to maintain this attractive asset by beneficial oral-health behavior, such as strict regimens of oral hygiene. Because this issue has hitherto not been addressed by research, 1 aim of this study was to explore whether young adults with excellent dental esthetics have more favorable oral-hygiene attitudes, preventive behaviors, and self-perceptions of oral health than those with adverse dental esthetics.

It is thought that regularity of the dental arches might facilitate oral hygiene, and prevention of caries and periodontal disease is thus a perceived benefit of orthodontic treatment.9-11 Firm evidence to support this perception is, however, lacking.11 On the other hand, special efforts and skills required for adequate oral hygiene during fixed appliance treatment, with professional instruction and monitoring, result in documented improvement of oral-hygiene compliance and effectiveness during orthodontics.12-14 Beneficial long-term oral-hygiene habits after orthodontic treatment might be viewed as enduring preventive oral health-care behavior. However, as shown by some studies, long-term adherence to preventive health care is usually rather difficult to achieve.15-17 It has been suggested that only continuous professional monitoring is effective in establishing a stable pattern of preventive behavior.18 The latter might be an expected long-term outcome of orthodontic treatment, which, because of its duration and contact intensity, facilitates continuous
professional monitoring. Information on this potential long-term effect of orthodontic treatment is scarce, and the second aim of this study was to assess long-term oral-hygiene adherence and self-perceived oral health of former orthodontic patients.

The concept of *locus of control* proposed by Rotter\(^1\) in the framework of the social-learning theory has been frequently applied to studying healthy preventive behavior. People with internal loci of control—ie, those who believe that their oral health depends on their own efforts—report more beneficial dental care behavior\(^2\) and show greater oral-hygiene improvements after professional instructions.\(^3\)

The potential role of so-called *dentofacial awareness*, which refers to an attentional focus on one’s own face and teeth as well as those of others,\(^4\) has hitherto not been studied in detail in health-related behavior. The so-called self-awareness theory states that attentional direction might to a substantial degree determine a person’s behavior,\(^5\) and it has been shown that a tendency to focus on oneself as a social object might raise concern about one’s own appearance and stimulate care for it.\(^6\)

According to health-behavior theories, the self-perceived value of a specific health condition is associated with relevant preventive actions.\(^7\) In orthodontics, the value of occlusion as assessed, for instance, on the scale designed by Tedesco et al\(^8\) is of substantial interest.

According to the cognitive social-learning theory, a person’s actions are guided by the expectation of the ability to perform a certain behavior and anticipation of favorable consequences as a result of that behavior.\(^9\) This concept has been applied to prediction of oral hygiene\(^10\) and behavioral changes related to it.\(^11,12\) Preventive behavior might include the expectancy to follow professional instructions, to be attentive to oral care, and to improve oral health. A further aim of this study was to elucidate the potential relationship between dental esthetics and previous orthodontic treatment on one hand and these attitudinal constructs in young adults on the other.

**MATERIAL AND METHODS**

Our subjects were 298 young adults aged 18 to 30 years (mean 25.04, SD 3.19); 57.6% were women, and 42.4% were men. The sample was homogenous with respect to level of education, comprising at least 13 years of primary and secondary school. Of the sample, 58.7% had a history of orthodontic treatment lasting on average 3.85 years (SD 2.05) and completed 9.25 years (SD 4.11) before the interview. The questionnaires were administered to the subjects individually, and the interviewers were male (A.B.) and female (Y.G.) doctoral dental students.

Dental esthetic appearance of each subject was assessed by 1 of the interviewers using the aesthetic component of the index of orthodontic treatment need (IOTN-AC).\(^13\) For subsequent analysis, high versus low levels of dental esthetics were obtained by median splits of all IOTN-AC values, and each subject was assigned to either the high-ranking or the low-ranking group. Thus, dental arrangements scoring grade 1 belonged to the high esthetics group, and those with scores of 2 or more belonged to the low esthetics group.

The scale for the assessment of dental health locus of control was derived from the health locus of control scale,\(^14\) which had previously been tested and applied in orthodontic research.\(^15\) This scale contains 11 items indicating self-responsibility for oral health in contrast to attributing it to external or unknown factors. Examples are “If I take care, I can avoid caries and gum disease” and “there are various unknown factors, and one never knows why she/he has bad teeth.” The internal consistency of this scale in our study was high, as shown by the Cronbach α of 0.72.

The dentofacial awareness scale described by Cunningham et al\(^10\) was modified for this study. The subjects were asked to indicate their agreement with 4 items on a 5-point scale. The attentional focus on one’s own face and dentition and those of others was assessed by the items “I spend much time looking at my teeth in the mirror” and “I look intensely into people’s faces” (Cronbach α 0.78).

The value of occlusion scale was also used.\(^10\) Respondents were asked to indicate their agreement with the meta-statement “A beautiful dental arrangement is important for . . . ” on items such as health, good appearance, and social acceptance (Cronbach α 0.72).

Preventive expectations were assessed with a specially designed scale containing 3 items that could be answered on a scale from 0 to 100 with decimal intervals. Oral-health behavior-performance expectation was assessed by the item “To follow my dentist’s oral hygiene instructions is . . . ” with the verbal anchors for the end points of the answering scale ranging from “extremely difficult” to “very simple.” Oral hygiene attention effectiveness was assessed by “I am aware of problem zones which must be attended during oral hygiene procedures” with the verbal anchors from “not at all” to “exactly.” Success expectancy was assessed by “What success do you expect from your oral hygiene for prevention of caries and gum bleeding?” with the verbal anchors from “none” to “great success.” The internal consistency of this scale...
was sufficiently high as shown by the Cronbach $\alpha$ of 0.66.

Preventive behaviors considered in this study included reports of frequency and regularity in dental brushing and flossing. Albeit subjective, these measures are sensitive to interventions and correlate with changes in clinical indicators.\textsuperscript{13-18} Frequency of tooth brushing was examined with a multiple-choice questionnaire.\textsuperscript{36} The respondents chose between “once a day,” “twice a day,” “three times a day,” and “more than three times a day.” Because regularity of tooth brushing is also an important aspect of oral hygiene effectiveness,\textsuperscript{37} this statement was added: “I brush my teeth regularly and carefully” to be answered on a 5-point scale. Both measures were combined in an aggregated variable by adding the standardized values to a sum score. The correlation between the contributing items was $r = 0.63$.

A multiple-choice format was also used to assess the frequency of dental-floss use with the alternatives “rarely or never,” “once a week,” “several times a week,” and “every day.” Flossing regularity was determined by answers to the statement “I use dental floss regularly” on a 5-point scale. Flossing frequency and regularity were added to an aggregated variable ($r = 0.83$).

Dental office attendance was assessed by asking the subjects to indicate on a 5-point scale their agreement with the statement “I regularly go to my dentist for checkups.” Attendance frequency was not considered, because this measure does not per se reflect compliance, which might be affected by other factors such as unfavorable oral-health status.\textsuperscript{38}

To assess self-perceived oral health, subjects were asked to report gingival bleeding and caries treatment. The related items were “Sometimes my gums bleed” and “I have to be treated for dental caries rather often.” The answering format was a 5-point Likert scale indicating agreement from “not at all” to “exactly.” Although assessment of self-perception of oral health has been hitherto scarcely used in dental research, it is considered to be of great value in evaluating strategies for health promotion.\textsuperscript{39-41}

In a subsample of 64 respondents, dental plaque accumulation was assessed by using the Quigley-Hein index\textsuperscript{42} which has been shown to be a reliable instrument for this purpose.\textsuperscript{36} After plaque staining, the coverage of the vestibular surfaces of all teeth was assessed on a 5-grade scale ranging from “no plaque” to “two thirds.” The index scores were calculated by adding the grades and dividing the sum by the number of teeth assessed. After 20 subjects were examined, an interrater reliability of $r = 0.92$ was found.

Two-factor analyses of variance were performed with ANOVA (SPSS for Windows release 10, SPSS, Chicago, Ill). The dependent variables were the measures related to oral-health attitudes, preventive behavior, self-perceived oral health, and dental plaque index as detailed above. The independent variables were history of orthodontic treatment (yes v no) and dental esthetics (high v low).

**RESULTS**

The Figure shows the IOTN-AC grades of the whole sample and the subgroups with and without history of orthodontic treatment. There was no statistically significant difference in IOTN-AC grades between the respondents with and without previous orthodontic treatment ($\chi^2 = 5.31, P = .26$).

The results of the 2-factor ANOVA with oral-health attitudes as the dependent variables are shown in Table I. With regard to the dental-health locus of
control, in contrast to the respondents with low-ranking dental esthetics, the high scorers on dental esthetics attributed dental health to a greater extent to internal causes. This difference was statistically significant \( F = 6.01, P = .015 \). In addition, the subjects who had undergone orthodontic treatment expressed stronger beliefs in internal control of dental health than those with no orthodontic history \( F = 5.32, P = .022 \).

With regard to dentofacial awareness, the subjects with high-ranking dental esthetics reported higher awareness than the low scorers. This effect was highly significant \( F = 13.57, P < .001 \). Dentofacial awareness was more intense in the respondents with histories of orthodontic treatment than in those without previous exposure to orthodontics \( F = 4.37, P = .037 \). The highest dentofacial awareness was reported by the subjects with both high dental esthetics and previous orthodontic treatment. A statistical tendency was found for the interaction of both independent variables \( F = 3.64, P = .057 \). In contrast to the low scorers, the subjects with high dental esthetics reported higher points on the value of occlusion scale \( F = 12.00, P = .001 \). Testing history of orthodontic treatment versus its absence resulted in no apparent differences in this dependent variable characterizing oral-health attitudes \( F = 0.00, P = .99 \). It is also shown in Table I that more favorable preventive behavior expectations were reported by the respondents with high dental esthetics \( F = 9.32, P = .002 \), whereas history of orthodontic treatment played no statistically significant role \( F = 0.47, P = .493 \).

The results of the analyses related to preventive behavior are shown in Table II. The high scorers on dental esthetics reported higher compliance with tooth brushing \( F = 13.06, P < .001 \). A statistical tendency was found for different use of dental floss \( F = 3.45, P = .065 \). Subjects with a history of orthodontic treatment reported more frequent and regular tooth brushing \( F = 8.01, P = 0.005 \) and use of dental floss \( F = 4.31, P = 0.039 \) than those without. Both the subjects with low dental esthetics and those without previous exposure to orthodontics reported a lower regularity of dental office attendance than their counterparts (dental esthetics \( F = 8.22, P = .004 \); history of orthodontic treatment \( F = 6.49, P = .011 \)). The interaction was significant \( F = 8.22, P = .009 \), indicating that the level of esthetics was associated with stronger differences in appointment regularity in the group with previous orthodontic treatment than in those with no orthodontic experience.

Analyses of the measures related to self-perceived oral health and dental plaque index are shown in Table III. The high scorers on dental esthetics reported less gingival bleeding \( F = 6.59, P = .011 \) and less caries treatment \( F = 8.14, P = .005 \) than the low scorers. Those with previous orthodontic treatment reported less gum bleeding and less caries treatment, too, but these differences were not statistically significant. Dental plaque index scores were lower in the high-esthetics scorers \( F = 4.74, P = .033 \) and in the subjects with history of orthodontics \( F = 4.74, P = .033 \).
DISCUSSION

We examined whether young adults differing in dental esthetics and in history of orthodontic treatment might be distinguished in their oral-health attitudes, reported adherence to oral-health preventive behavior, and self-perceptions of oral health. The instruments used to assess oral-health-related variables are primarily subjective perceptions of the study subjects. Both preventive behavior reports and self-perception of oral health, however, are regarded as sufficiently sensitive measures when used in evaluations of health interventions and other oral-health investigations, and their use seems entirely reasonable and suitable in this study. Young adults with high levels of education were included to obtain a homogenous sample with respect to age and educational background, which are known to have a substantial influence on oral-health attitudes and behavior. In general, dental esthetics of our subjects received high scores on the IOTN-AC scale. Strictly speaking, extrapolation of these findings should be confined to people with these socio-demographic and esthetic characteristics.

Among dental attitudes, the concepts of locus of control, dentofacial awareness, value of occlusion, and preventive behavior expectations were assumed to be relevant in this study. Subjects with different levels of dental esthetics were different with regard to all 4 attitudinal variables. As shown by the results, respondents with high-ranking dental esthetics tended to attribute their personal oral health to their own preventive behaviors (internal control orientation). According to the theory of attribution processing, a person generally prefers to credit a favorable event, outcome, or feedback to her or his own efforts or characteristics; failures are excused as either accidental or resulting from unknown external causes. Beneficial dentofacial

Table II. Results of 2-factor analyses of variance with history of orthodontic treatment and dental esthetics as independent variables and reported preventive behavior as dependent variable. Mean, SD, and F and P values for statistical significance are shown.

<table>
<thead>
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<th>Yes</th>
<th>Degrees of freedom</th>
<th>Interaction</th>
<th>Esthetics</th>
<th>Orthodontics</th>
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<tr>
<td></td>
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<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<td>P</td>
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<td>1.72</td>
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<tr>
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<td>0.59</td>
<td>1.90</td>
<td>1; 294</td>
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<td>0.18</td>
<td>1.95</td>
<td>1; 294</td>
<td>0.01</td>
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<td>2.86</td>
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<td>Low esthetics</td>
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<td>2.86</td>
<td>1.36</td>
<td>1; 294</td>
<td>0.68</td>
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</table>

Table III. Results of 2-factor analyses of variance with history of orthodontic treatment and dental esthetics as independent variables and reported oral health and plaque accumulation as dependent variable. Mean, SD, and F and P values for statistical significance are shown.

<table>
<thead>
<tr>
<th>History of orthodontic treatment</th>
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<th>Yes</th>
<th>Degrees of freedom</th>
<th>Interaction</th>
<th>Esthetics</th>
<th>Orthodontics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>F</td>
<td>P</td>
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<tr>
<td>Reported gum bleeding</td>
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<tr>
<td>Reported caries treatment</td>
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<td></td>
<td></td>
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<td>1.90</td>
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<td>1.17</td>
<td>1.24</td>
<td>1; 295</td>
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<td>0.43</td>
<td>0.34</td>
<td>1; 63</td>
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<td>0.22</td>
<td>0.59</td>
<td>0.24</td>
<td>1; 63</td>
<td>0.00</td>
</tr>
</tbody>
</table>
esthetics elicit favorable social feedback, which in turn might strengthen the tendency to feel responsible for one’s own oral health.44

The results of this study suggest that subjects with advantageous dental esthetics might develop more acute dentofacial awareness; this agrees with the results of psychosocial research, showing that physically attractive people enhance their self-esteem by looking at their own mirror images or portraits and comparing their appearance with that of others, whereas unattractive people tend to avoid such encounters and comparisons.45

Furthermore, as suggested by our results, people with high-ranking dental esthetics appear to hold stronger beliefs that dental arrangement is important for healthy appearance and successful social interactions (value of occlusion) than do subjects with less beneficial dental esthetics. This finding is in accord with the theory of cognitive dissonance,46 which states that persons ranking low on a specific trait restore their self-esteem by devaluing its significance, whereas those ranking high on that trait tend to enhance their self-esteem by emphasizing its value.

Our findings suggest that expectations of beneficial outcomes of personal oral-health behavior were different in subjects with high- and low-ranking dental esthetics. This parallels the results of research on the cognitive-social learning theory, showing that expectancies of performance ability and success depend on previous experience of related behavioral efficiency.47

Possibly, those with high-ranking dental esthetics perceive their dental arrangement as a result of personal preventive behavior, which, in addition, might generally strengthen favorable preventive expectations.

The subjects with and without previous orthodontic treatment had differences in 2 attitudinal variables. Those with a history of orthodontic treatment reported that they felt more responsible for their own oral health—ie, showed more internal control orientation—than those without previous exposure to orthodontics. The explanation is that, during orthodontic treatment, favorable compliance usually leads to an improvement of dental esthetics. In addition, a history of orthodontic treatment seemed to enhance dentofacial awareness, having a stronger effect in high scorers on dental esthetics (statistically significant interaction effect). It appears that attention to dentofacial appearance was most satisfying to this group of subjects. The measures assessing value of occlusion and preventive behavior expectations, however, did not parallel these findings; they showed no differences between the subjects with and without histories of orthodontic treatment.

Self-reported preventive behavior included 2 aggregated variables: frequency and regularity of tooth brushing and flossing, and regularity of dental office attendance. Subjects with excellent dental esthetics reported more dental care (brushing and dental visiting) compared with those with minor irregularities. Low scorers on dental esthetics might be inclined to avoid confrontations with their unfavorable esthetic conditions when looking into the mirror during tooth cleaning or in visiting the dentist. Previous studies on general physical attractiveness have shown that attractive people exercise more and have better health habits to maintain their beneficial appearance.5-8 Our results extend these findings to esthetic dental appearance.

Respondents with previous orthodontic treatment reported better compliance with oral hygiene and dental office attendance. It has been hypothesized that oral-hygiene instruction and long-term monitoring as practiced during orthodontic treatment might enhance stable preventive behavior patterns.12-18 Our observations lend support to this assumption. However, a potential caveat must be considered because of the subjective nature of the measures used. Former orthodontic patients might feel obliged to report compliance, or they might have a more positive self-concept about dental care. On the other hand, several studies have suggested that oral-hygiene reports are related to objective measures.13-18 Further studies including subjective indicators of compliance and self-observation protocols of oral hygiene would help to clarify this issue.

Subjective perception of oral health was assessed by means of reported frequency of gingival bleeding and carries treatment. In addition, plaque accumulation was assessed in a subgroup of subjects. It was found that high scorers on dental esthetics reported less bleeding and carries treatment than their counterparts. This was supported by plaque accumulation differences found in the plaque assessment subgroup; this was also in accordance with reported oral hygiene behavior. Subjective ratings of oral health have been used in other recent studies identifying interesting, albeit not objective, relationships to socio-demographic parameters.39-41 Ideally, further studies including clinical examination of oral health status should be carried out to confirm and extend these findings.

In addition, in the plaque assessment subgroup, less plaque accumulation was found in the subjects with previous orthodontic treatment. This observation was consistent with self-reported oral-hygiene adherence. Because orthodontic treatment was accomplished in our subjects on average 9.25 years earlier, these interesting findings certainly warrant further attention in studies of the benefits of orthodontic treatment.

These results suggest that orthodontic treatment and
highly esthetic dental appearance might have an enduring effect on oral-health attitudes, possibly on dental-hygiene behavior, and even on oral-health state. However, 3 cautionary notes should be kept in mind. First, better health-related behaviors and better oral health might be more typical of well-educated young adults. This might also, at least in part, account for the narrow range of dental esthetics and reported compliance, and greater effects might thus be anticipated in a sample with wider variations. On the other hand, however, dental awareness might be particularly high in our sample, favoring, in turn, identification of significant differences. Further studies including subjects of higher age and lower education are required to confirm our observations. Second, most variables studied here are subjective. It would be worthwhile for further studies to include a detailed objective clinical examination of oral-health status. Third, to determine potential causal relationships, longitudinal research of associations between changes in dental esthetic and dental health attitudes and behavior should be conducted.

REFERENCES

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