Evaluation of the effects of malocclusion and orthodontic treatment on self-esteem in an adolescent population

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Introduction: The purpose of this study was to evaluate the effects of malocclusion and orthodontic treatment on adolescent self-esteem. Methods: A total of 4509 middle school students were clinically evaluated for dental crowding. Lip protrusion was also measured with a specially designed ruler. Rosenberg’s self-esteem scale was used to determine each subject’s level of self-esteem. Results: The results showed that sex played a role in the relationship between self-esteem and malocclusion. For the girls, crowding of the anterior teeth had significant effects on their self-esteem; however, there was no significant difference in the boys’ self-esteem. After fixed orthodontic treatment, the girls had higher self-esteem than the untreated malocclusion group. Girls with an ideal profile and good tooth alignment also showed higher self-esteem than students with crowding or protrusion. Conclusions: This clinical study proved that malocclusion and fixed orthodontic treatment can affect self-esteem in adolescent girls. (Am J Orthod Dentofacial Orthop 2010;138:160-6)

Orthodontic therapy is normally started for cosmetic considerations. Dentofacial problems causing cosmetic impairment are detrimental because of their adverse effect on an adolescent’s self-esteem and possible unfavorable social responses. The latter disadvantage might be in the form of blatant teasing and ridicule, particularly during childhood or more subtly as social bias. Such preconceptions are, of course, harmful if they become self-fulfilling prophecies.

Many factors related to malocclusion have strong influences on perceptions of facial esthetics, and many studies were done with various measurements and subjects. Recently mentioned factors are anterior tooth alignment, tooth shape and position, lip thickness, symmetric gingival or tooth contour, lip profile, overjet, and so on. Studies have proven that perceptions of facial esthetics influence psychological development from early childhood to adulthood. Infants show visual preference for human faces, and, by age 8, children’s criteria for attractiveness are the same as those of adults. A teacher’s perceptions of a student’s attractiveness can influence the teacher’s expectations and evaluation of the student.

Children perceived as more attractive are not only more socially accepted by their peers, but also believed to be more intelligent and to possess better social skills. In addition, employees perceived as more attractive by their supervisors are given better job-performance ratings than less attractive employees. Thus, those who are perceived by their teachers, peers, and employers to be attractive are more likely to experience positive social interactions and evaluations.

Although these relationships are well known and accepted, the direct relationship between self-esteem and malocclusion or orthodontic treatment has not yet been proven. Dann et al examined changes in self-concept during Class II treatment with an activator, showing a slight increase, but the changes after orthodontic treatment were found to be insignificant. O’Brien et al, however, verified that patients showed significant improvements in self-concept and self-esteem after Twin-block appliance therapy for the treatment of Class II Division 1 malocclusions.

The purpose in this study was to evaluate the influences of malocclusion and orthodontic treatment on adolescents’ self-esteem. To a layperson, anterior tooth alignment or protrusion would be the most conspicuous characteristics related to malocclusion; therefore, the effects of anterior crowding and lip protrusion on self-esteem were measured, and the influences of orthodontic treatment on self-esteem were also evaluated.
MATERIAL AND METHODS

The sample consisted of adolescents aged 12 to 15 years from the first to third grades of 5 middle schools in Seoul, Korea. To control for the effects of socioeconomic status and location, we chose middle schools in Kang-nam Gu and Seo-cho Gu, which are in neighboring districts and represent middle to upper income groups. A total of 5343 middle school students were examined (Table I).

Questionnaires designed to determine the students’ self-esteem were sent to the middle schools 1 week before the clinical examinations. They were then collected shortly before the examinations, so that the examiners would not know which students had high self-esteem.

Five orthodontists examined the subjects’ occlusal statuses and facial profiles. To minimize potential inter-examiner differences, the methods of measurement and rules of grouping were explained, and sham clinical tests were performed before the examinations. To eliminate the effects of sex differences, statistical data from the boys and girls were analyzed separately.

To be included in the final study group, the samples had to satisfy all of the following criteria: (1) buccal segment (canines and premolars) eruption was completed; (2) there were no craniofacial anomalies, including cleft lip or palate; (3) all first molars were in place with no proximal caries or restorations; (4) there were no congenital missing teeth or impacted teeth mesial to the first molar; (5) and the questionnaire had been fully completed.

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle SA. If you agree with the statement, circle A. If you disagree, circle D. If you strongly disagree, circle SD.

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

Scoring

Q 1, 3, 4, 7, 10: SA=4, A=3, D=2, SD=1.
Q 2, 5, 6, 8, 9: SA=1, A=2, D=3, SD=4.

Fig 1. Rosenberg’s self-esteem scale.\(^{18}\)

focused on self-esteem than other scales related to self-concept.\(^{22}\)

The self-esteem questionnaire consisted of 10 questions; 5 were positive, and 5 were negative. For each negative statement, the answer was counted and added to the total score. For each positive statement, the answer was subtracted from 5, and then the remainder was added. In this study, self-esteem was evaluated...
based on the self-esteem index (SI). The SI was calculated by dividing the total score by 10. A subject with high self-esteem had a high SI score.

I classified the samples in 2 ways; the first classification was based on the profile and tooth alignment, and the second classification was based on the history of orthodontic treatment.

The most frequent reasons for seeking orthodontic treatment are protrusion and maxillary anterior crowding. Therefore, these conditions were evaluated (Table II), and we tried to measure their psychological influences. Protrusion at Ricketts’ E-line was measured clinically with a metal ruler with a 2-mm deep section removed at the middle (Fig 2). If the upper and lower lips touched the middle of the ruler simultaneously (showing protrusion of more than 2 mm), the subject was classified in the protrusion group (PG).

Arch-length discrepancy in the maxillary anterior teeth was also evaluated. If more than 4 mm of arch-length discrepancy was suspected and the lips did not touch the ruler, the subject was classified in the crowding group (CG). Subjects who had both maxillary anterior crowding and lip protrusion were classified as the crowding and protrusion group (CPG). The normal group (NG) consisted of subjects with anterior crowding less than 1 mm, a Class I molar relationship, and a good profile. If these characteristics did not fit a subject or the clinical judgment was inconclusive, the student was put into the rest (TR) group. Molar relationship was a factor only in the NG. When classifying groups of malocclusion, whether the subject had prior experience with removable orthodontic appliances or headgear was not considered important. When the subject had prior experience with fixed orthodontic appliances, however, crowding and protrusion were not evaluated, and subjects were classified as the fixed orthodontic (FO) treatment group or the debonding group (finished fixed orthodontic treatment, DB).

All subjects were reclassified according to their histories of orthodontic treatment (Table III). The SI scores were compared among the FO, DB, removable orthodontic treatment (including headgear) (without fixed orthodontic treatment experience: RO), and no orthodontic (NO) treatment experience groups.

The SI scores of each group were compared by using 1-way analysis of variance (ANOVA) and the Scheffé multiple comparison. Boys and girls were compared separately.

RESULTS

Of the 5343 students examined from 2 all-girl schools and 3 coeducational schools, 4509 students who met the inclusion criteria were evaluated (Table I).

For the boys, the FO and DB groups included 13.48% (n = 211) and 9.07% (n = 142), respectively. More than a quarter (26.56%) of the sample had FO treatment. Among the RO (n = 166) and NO (n = 1996) subjects, 8.05% (n = 174) showed maxillary anterior crowding (>4 mm; CG), and 4.17% (n = 90) exhibited lip protrusion that exceeded 2 mm (PG). Only 13 subjects had

**Table II. Subjects grouped by types of malocclusion**

<table>
<thead>
<tr>
<th>Group</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>CG</td>
<td>Maxillary anterior (canine to canine) crowding &gt;4 mm. Upper and lower lip protrusion to E-line &lt;2 mm on both lips. No orthodontic treatment with fixed appliances.</td>
</tr>
<tr>
<td>PG</td>
<td>Maxillary anterior (canine to canine) crowding &lt;4 mm. Upper and lower lip protrusion to E-line &gt;2 mm on both lips. No orthodontic treatment with fixed appliances.</td>
</tr>
<tr>
<td>CPG</td>
<td>Maxillary anterior (canine to canine) crowding &gt;4 mm. Upper and lower lip protrusion to E-line &gt;2 mm on both lips. No orthodontic treatment with fixed appliances.</td>
</tr>
<tr>
<td>NG</td>
<td>Class I molar relationship, crowding on both arches &lt; 1 mm. Good profile and no orthodontic treatment.</td>
</tr>
<tr>
<td>TR</td>
<td>The rest of the subjects.</td>
</tr>
</tbody>
</table>

**Fig 2. Evaluation of lip protrusion with the metal ruler.**
both maxillary anterior crowding and lip protrusion (CPG; 0.6%). The NG was 6.11% (n = 132) of the sample, and TR group was 59.54% (n = 1753).

Because there was no statistically significant difference between the SI scores of the girls in coeducational and all-girl schools, the findings were evaluated without school discrimination.

For the boys, their orthodontic treatment history made no difference in self-esteem levels; however, for the girls, self-esteem increased after FO treatment (Table IV).

The CG, PG, and CPG exhibited lower SI scores, but without a significant difference in the male sample. For the female sample, the CG had a significantly decreased SI score, but the PG did not (Table V). There was no difference in the SI scores between the NG and the DB group based on sex.

To observe the detailed responses of the subjects between the groups, the points of each of the 10 questions were compared. Because only the NG and CG of the girls showed significant differences, their responses were compared in Table VI. Except for questions 3, 4, 7, and 8, the results were significantly different ($P < 0.05$).

**DISCUSSION**

We chose the Kang-nam Gu and Seo-cho Gu districts for this experiment. Many people in these areas have a similar socioeconomic statuses. In these areas, nearly half of the people live in apartments with similar costs; they usually have 1 or 2 children and are enthusiastic about educating them. The percentage of students who underwent orthodontic treatment was much higher in these areas than in any other area in Korea. We tried to find an administrative district composed only of apartments of similar size and cost. Eleven middle schools were found and asked for permission to conduct our study. Only 7 schools gave approval and, because of scheduling problems, 5 were chosen finally.

We evaluated only characteristics of malocclusion that are detectable by laypersons; therefore, the Angle classifications were not considered.

### Table III. Subjects grouped by history of orthodontic treatment

<table>
<thead>
<tr>
<th>Group</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB</td>
<td>Finished fixed orthodontic treatment (after debonding of fixed appliances)</td>
</tr>
<tr>
<td>FO</td>
<td>During fixed orthodontic treatment</td>
</tr>
<tr>
<td>RO</td>
<td>During or finished removable appliance (including headgear) orthodontic treatment</td>
</tr>
<tr>
<td>NO</td>
<td>No orthodontic treatment</td>
</tr>
</tbody>
</table>

### Table IV. Comparison of self-esteem index (SI) scores of the groups

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th></th>
<th>Girls</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>SI</td>
<td>n</td>
<td>SI</td>
</tr>
<tr>
<td>DB</td>
<td>143</td>
<td>2.89 ± 0.48A</td>
<td>316</td>
<td>2.86 ± 0.43A</td>
</tr>
<tr>
<td>FO</td>
<td>211</td>
<td>2.86 ± 0.46A</td>
<td>466</td>
<td>2.75 ± 0.42B</td>
</tr>
<tr>
<td>RO</td>
<td>85</td>
<td>2.76 ± 0.41A</td>
<td>166</td>
<td>2.75 ± 0.47B</td>
</tr>
<tr>
<td>NO</td>
<td>1126</td>
<td>2.80 ± 0.47A</td>
<td>1996</td>
<td>2.71 ± 0.45B</td>
</tr>
</tbody>
</table>

The same letters were not statistically significant at $P = 0.05$ with the Scheffé multiple comparison.

The RO group showed no significantly different SI values (Table IV). Usually, anterior tooth alignment or lip protrusion cannot be completely corrected by RO treatment. Even if the orthodontic treatment had made a significant improvement, psychological improvement might not have been observed if there was still some degree of malocclusion. Since the type of removable appliance and the occlusal status of each subject were not examined and compared, the effects of each specific appliance could have differed.

FO treatment can correct tooth alignment quickly, but this method seemed to have no effect on self-esteem during treatment. This might be related to the conspicuousness of the fixed appliance, discomfort during treatment, or an adverse effect on the subject’s facial profile. After FO treatment, however, increased self-esteem was noted in the girls.

The PG did not show a significant difference, but the CG had a lower SI score in the girls. Protrusion seemed to be an unnoticeable feature in middle school students. Anterior tooth alignment is usually straight after fixed appliance treatment, which contributed to the DB group’s significantly higher SI score in the girls.

The SI score of the CPG group was not lower; this was probably due to the small number of subjects (Table V).

The demand for orthodontic treatment is mainly motivated by concern about appearance and a desire to improve appearance. But there can be cultural or ethnic differences about ideal appearance or standards of beauty. The most frequently mentioned chief complaints of orthodontic patients are crowding, overjet, and overbite. But, in Korea, overjet and overbite are not frequently mentioned complaints because of few Class II orthodontic patients. Crowding is the most frequent complaint, and a protrusive profile is the second in Korean nonsurgical orthodontic patients.

Protrusion was evaluated only when it exceeded 2 mm for both upper and lower lips. This was because the average lip protrusions to Ricketts’ E-line in Korean
women are $-0.86 \pm 2.15$ mm (upper) and $0.56 \pm 2.30$ mm (lower). For adolescent patients who are still growing, lip protrusion usually decreases by 0.2 mm annually because of nasal growth. Therefore, protrusion greater than 2 mm is similar or greater than 1 SD.

Possible causes of lip protrusion are retrusive chin, low nasal height, labioversion of the incisors, large overjet, and others. A layperson cannot usually distinguish the differences between these problems; therefore, we did not classify the origin of protrusion. The important factor in this study was the influence of personal perception on a subject’s appearance.

Evaluation of arch length discrepancy would be more precise for model analysis, but, in a study with a large sample, clinical assessments can be used to evaluate crowding. To minimize clinical observation errors, a sham clinical test with study models was used before the examinations, and any subject who could not be classified with confidence was grouped in TR.

The United States Public Health Service determined the standard of crowding as more than 6 on the irregularity index. Between the ages of 12 and 17 years, 32.5% had values greater than 6; this percentage was too large to evaluate the influence of crowding. In this study, more than 4 mm of crowding (irregularity index, $>8$) was chosen as the standard for the CG or CPG. In these subjects, crossbite of the lateral incisors or a high canine, which is easily detected by a layperson, was usually seen. In girls, a lower SI score was seen in the CG.

Dann et al. argued that Class II malocclusions in children younger than 15 years did not cause a lower self-concept than that in the control group, and orthodontic treatment with an activator would not change the self-concept significantly. However, O’Brien et al. showed that children who received early orthodontic treatment with a Twin-block appliance reported higher self-concepts and more positive childhood experiences than did the control group, which had received no orthodontic intervention. They insisted that the results of Dann et al. were due to the small amount of the improvement during orthodontic treatment (eg, overjet reduction was only 2.1 mm). In our study, the PG had no significant difference in the SI scores. Since many Class II Division 1 patients have lip protrusion, and the PG did not have a different level of self-esteem, our results are similar to those of Dann et al. In addition, the SI score of the RO group was not significantly different from that of the NO group.

Shaw et al. found that, for children, anterior crowding is more noticeable than a large overjet, with the former an object of ridicule. Kilpeläinen et al. reported that, according to the parents, orthodontic treatment of anterior crowding for children between 12 and 16 years of age was 2.2 times more often motivated by the child, rather than by the parents or a dentist. However, if a child had a large overjet, then parents were 3 times as likely to be the first to notice the need for orthodontic treatment. In another study about the psychosocial implications for 30-year-old adults, a large overjet was the most noticeable feature of malocclusion, with maxillary incisor crowding the second.

Jung et al. showed that a protrusive profile and crowding had significant reducing effects on the level of self-esteem in female university students. Many studies showed similar results and concluded that the tendency to consider protrusion as less attractive occurs more often in adults than in younger groups.

In a study published in 1981, Kiyak et al. examined whether there were any differences in psychological functioning between male and female patients before and after surgery. Before surgery, male subjects were significantly more satisfied with their facial profiles than were the female subjects; however, a month after surgery, the males were less satisfied than the females. Holmes found that more females perceived themselves as having less attractive dentitions and greater
treatment needs, despite a lack of objective evidence supporting this view. In that study, 51.7% of the female subjects thought that they required orthodontic treatment, although only 32.3% had responded that they disliked the appearance of their teeth. Helm et al also showed that malocclusion is more worrisome to women than to men. Thus, there seem to be different psychosocial impacts between the sexes in their perceptions of facial and dental appearances. The results of our study also support these findings.

Because the ages of subjects were 12 to 15 years, many were having orthodontic treatment, and the percentage of FO was greater than that of DB. Although we could not find any evidence that children who matured earlier had higher self-esteem, there could be influences of early maturation in the different self-esteem scores of the DB group. Further investigation is needed to evaluate these maturation-related differences.

The appearance of the mouth and the smile plays an important role in other people’s judgment of facial attractiveness. Previous surveys showed that most people believe dental appearance to be important in social interactions. However, the impact of dental or perioral appearance differs among various sex and age groups. In adolescence, girls perceive dental appearance as a more important characteristic, with maxillary anterior crowding having a greater influence than protrusion. Consequently, fixed orthodontic treatment would be helpful in increasing the self-esteem of a girl with anterior crowding.

CONCLUSIONS

In this psychological assessment of a large adolescent population, we found that anterior crowding causes low self-esteem in adolescent girls. FO or RO treatment could not improve self-esteem during treatment; however, after fixed treatment, significantly higher self-esteem was observed in the girls. Subjects who finished FO treatment showed similar levels of self-esteem as did those with normal occlusion and good profile. For the boys, there was no significant difference in self-esteem between the groups.

REFERENCES


