Perception of Facial Esthetics: A Comparison of Similar Class II Cases Treated with Attempted Growth Modification or Later Orthognathic Surgery

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Abstract: In recent years, there has been considerable interest in the esthetic outcomes of various types of Class II treatment. In this study, it was the authors' intent to determine the esthetic outcomes for 60 Class II division 1 patients: 28 patients treated during the active growth phase with an activator and fixed appliances and 32 patients treated at the completion of growth with fixed appliances and by orthognathic surgery. Using a visual analogue scale, a mixed panel of 14 judges scored the pre- and posttreatment attractiveness of these patients from frontal and lateral facial photographs. Statistical analysis by two-sample *t*-tests indicated that, on average, esthetic scores improved with treatment, regardless of the treatment modality. There was, however, considerable individual variation in the degree of improvement, even to the point that there was a decline in esthetics for some patients. Despite somewhat different modes of treatment, it was found that neither the average pre- and posttreatment esthetic scores nor the change in esthetic score with treatment was significantly different for the two groups. Although clinical planning decisions should still be made on an individual basis, the findings of this study suggest that the perceived esthetic outcome in many Class II division 1 patients may well be just as favorable, regardless of whether they are managed early during the growth phase or later, at the completion of growth by orthognathic surgery. (*Angle Orthod* 2003;73:365–373.)

Key Words: Class II occlusion; Mandibular advancement; Functional appliances; Visual analogue scale

INTRODUCTION

Physical attractiveness is highly regarded and desired in contemporary society. This is not surprising given that those who are physically attractive apparently have greater social acceptance¹ and are more desired as friends² and dating partners.^{3,4} Furthermore, attractive individuals are perceived to be more intelligent,^{5,6} happier,⁷ and tend to be more successful in the workplace⁸ than their less attractive peers. Given the numerous perceived, and perhaps real, benefits associated with attractive appearance, one can understand why members of the general public might subject themselves to procedures that are likely to enhance their esthetic appeal. Thus, it is not surprising that the demand

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for orthodontic care seems to be largely driven by the desire to improve one's appearance.^{9–12}

There is no doubt that orthodontic treatment can have a significant effect on facial esthetics. Angle¹³ recognized, however, that this effect could be for better or for worse, stating that the orthodontist "for each of his efforts, whether he realizes it or not, makes for beauty or ugliness, for harmony or disharmony, or for perfection or deformity of the face". Bearing this in mind, it is no surprise that contemporary orthodontic treatment philosophies favor treatment plans that not only meet occlusal and functional ideals but also optimize dental and facial esthetics.

Class II correction and the esthetic and functional goals may be achieved by one of four possible approaches. These include attempted growth-modification treatment, tooth movement to compensate for any jaw discrepancy (camouflage), some combination of those first two, or the surgical repositioning of the jaws. In situations where the discrepancy between the mandible and maxilla is significant, skeletal correction, either by surgery or by successful growth modification, would be the treatment of choice. If skeletal correction is not achieved or is not achievable with these methods alone, dentoalveolar camouflage treatment may still be required. Although there is a wide range of

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individual variation, such compensation for mandibular retrognathism by conventional orthodontic treatment incurs the risk of an increased nasolabial angle, reduced upper lip support, and increased facial convexity, all of which may adversely affect facial esthetics.^{14,15}

Most research with respect to growth-modifying functional appliances and facial esthetics has involved the assessment of profile changes, with the assumption that profile changes somehow correlate with esthetic improvement. Typically reported changes with successful growth-modification treatment include a reduction in soft-tissue profile convexity, an increase in facial height, advancement of all skeletal, dental, and soft-tissue mandibular structures, and an uncurling of the lower lip, resulting in a decrease in the labiomental angle.^{16,17} These profile changes seem to be the norm, regardless of the functional appliance used,¹⁸⁻²⁰ although substantial individual variability in profile changes is observed.^{19,21} On the basis of the findings of all these studies, claims that the use of these appliances result in dramatic improvement in the esthetics of the entire lower face and in a more attractive profile would appear to be justified. There is, however, little quantitative evidence to support these claims. In fact, O'Neill et al²² found that the treatment of Class II division 1 malocclusions with functional appliances does not inevitably lead to more attractive profiles.

With successful combined surgical-orthodontic correction of mandibular deficiency, facial proportions tend to become balanced and cephalometric values approach norms,²³ suggesting that facial esthetics will be improved. In fact, this line of thought seems to be supported by the fact that, in most cases, facial esthetics are improved after surgical correction of a skeletal Class II malocclusion.^{24–27}

There has been a significant amount of research comparing surgical and camouflage Class II treatment, indicating that surgical skeletal modification generally results in better esthetic outcomes.^{25,28} Reports on comparisons of camouflage treatment with functional appliance treatment are, however, difficult to find. In one study at least, Battagel²⁹ indicated that nonextraction functional appliance treatment generally leads to a more favorable lateral facial profile than does camouflage treatment, although how this profile change affected overall facial esthetics was not evaluated. Any conclusions regarding overall esthetic improvement are, therefore, speculative.

Unfortunately, there seems to be little, if any, information in the literature dealing with a direct comparison of esthetic outcomes in Class II patients after either surgical or attempted growth-modification techniques. With this in mind, this study was designed to assess the various esthetic outcomes in Class II division 1 patients treated either during the growth phase with an activator and fixed appliances or at the completion of growth with fixed appliances and by orthognathic surgery.

Sample

The sample consisted of 60 patients who presented for treatment of their Class II division 1 malocclusions. The records of the patients were taken from the private practices of two experienced orthodontists. Although records were selected without reference to end of treatment occlusal standard, in both practices, the occlusal aims of treatment were apparently those as recommended by Roth³⁰ and Andrews.³¹ To be included in the sample, the following criteria had to be satisfied:

- The patient had to have a Class II division 1 occlusion with a minimum overjet of five mm or a minimum ANB angle of 5° (or both). While recognizing that, on first view, an incisal overjet of five mm does not seem particularly severe; the reality is that this equates to buccal segments, which are approximately three-fourths of a unit Class II. In a nongrowing patient with such an occlusion, treatment choices are often limited to either the extraction of teeth, with potential negative facial effects, or orthognathic surgery.
- The following records had to be available: pre- and posttreatment lateral cephalograms and frontal and lateral photographs taken with the lips at rest.
- The patient had to have been treated by one of the two methods: (1) with upper and lower fixed appliances and by orthognathic surgery or (2) with an activator for attempted growth-modification followed by upper and lower fixed appliances. Extractions of premolar teeth may have been a part of the treatment provided for subjects in either group.

The sample was divided into two groups on the basis of the method of treatment. Thus, the surgery group comprised 32 patients, 23 females and nine males. Of these surgical patients, 23 cases were treated by mandibular surgery alone and nine cases by bimaxillary surgery. The group treated during the growth phase comprised 28 patients, 17 females and 11 males. A summary of selected sample characteristics is given in Table 1.

Two-sample *t*-tests, used for comparing the two groups, confirmed that the surgery group was significantly older than the attempted growth-modification group ($P \le .001$). The average pretreatment age was 23.5 years for the surgery group and 10.8 years for the growth-modification group. For the posttreatment records, average ages were 26.4 years and 14.9 years, respectively. The duration of active treatment was significantly shorter for the surgery group, being on average 2.7 years compared with 4.1 years for the growth-modification group, the duration of treatment included both phases 1 and 2, whether or not there was a pause between the two phases.

There was no statistical difference in the severity of mal-

TABLE 1. Sample Characteristics^a

	Pretreatment Record			Posttreatment Record				
	Age (y)	ANB Angle (°)	Incisal Overjet (mm)	Age (y)	ANB Angle (°)	Incisal Overjet (mm)		
Surgery group								
Mean	23.5	6.4	8.5	26.4	3.5	2.5		
SD	9.6	2.6	2.7	9.5	2.0	0.5		
Minimum	11.2	0.5	3.5	15	-1.0	2.0		
Maximum	44.6	11.5	15.5	47.5	8.0	4.0		
Growth-modification group								
Mean	10.8	6.4	9.4	14.9	3.9	2.8		
SD	1.1	1.9	2.3	1.4	2.1	0.9		
Minimum	9.0	2.0	3.5	11.8	1.0	1.0		
Maximum	13.4	10	14.5	18.2	9.5	4.5		

occlusion, as assessed with the ANB angle and incisal overjet, for the two groups either before or after treatment. The mean pretreatment ANB angle was 6.4° for both groups, with the mean incisal overjet being 8.5 mm for the surgery group and 9.4 mm for the growth-modification group. At the end of active treatment, mean ANB angles were 3.5° and 3.9° and incisal overjets were 2.5 mm and 2.8 mm for the surgery and growth-modification groups, respectively.

Esthetic rating

A panel of judges was selected to obtain estimates of perceived facial attractiveness. The panel included two plastic surgeons, two oral surgeons, two orthodontists, two lay people, two general dentists, two artists, and two modeling agency employees. Seven judges were male and seven were female.

Each judge viewed color, standard-sized (8 \times 12 cm) frontal and right-lateral photographs taken at rest. The preand posttreatment photographs for the entire sample were arranged in random order in a folder, with the lateral and frontal photographs shown simultaneously. The protocol of showing both views together as recommended by Phillips et al³² was chosen because the perception of attractiveness is apparently affected by the particular view of the patient being presented to the assessor.^{33,34} Photographs of individuals smiling were not used because any irregularity of the dentition may have adversely affected the rating of facial attractiveness.

The assessment of facial attractiveness was based on the method documented by Phillips et al,³² using separate 100mm visual analogue scales anchored on the left by the descriptor "very unattractive" (0) and on the right by "very attractive" (100). The judges were instructed to view the frontal and lateral photographs together and to record an overall rating by marking the scale where their rating of the patient's attractiveness would fit. At any one time, photographs of only one patient were visible to the judge. An additional pair of photographs of one individual, not in-

cluded in the sample, was placed on the first page of the folder, so that the judges could first familiarize themselves with the rating procedure. A rating score was obtained for each patient by measuring the distance (mm) from the very unattractive end of the scale to the mark made on the scale by the judge. The esthetic rating process for every patient was repeated a minimum of four weeks later. Both the first and second ratings were averaged to give the patient's final esthetic rating for a particular judge. Each patient's final pre- and posttreatment esthetic rating was then taken as the average score from all 14 judges. Intraexaminer reliability was statistically evaluated by Spearman rank correlation, comparing each judge's first and second sets of ratings. All correlations were statistically significant, with correlation coefficients ranging from .314 to .791, suggesting that all judges were sufficiently reliable.

All data obtained were statistically analyzed (two-sample *t*-tests) and used to assess pre- and posttreatment facial esthetics, as well as any change in esthetics, after Class II treatment with either attempted growth modification or later orthognathic surgery.

RESULTS

The pre- and posttreatment esthetic scores (Figure 1) and the numeric and percentage changes in esthetic scores for both the surgery and growth-modification groups are presented in Table 2. Two-sample *t*-tests revealed that there were no statistically significant differences between the two groups for any of these measures. On average, the esthetic scores improved with treatment, although the degree of improvement was quite variable. Some patients had a marked improvement in esthetics, whereas others had a significant worsening in esthetics. This appeared to be the case, regardless of the treatment technique.

The number of patients with an increase, decrease, or no change in facial attractiveness are presented in Table 3. In the surgery group, 22 of 32 patients had higher esthetic scores after treatment, with the remaining 10 patients having lower esthetic scores. In the growth-modification group, 21 of 28 patients had higher esthetic scores and seven had lower esthetic scores after treatment. In many patients, the difference in esthetic score was very small. When the data were reassessed, with a difference in pre- and posttreatment esthetic scores of less than 5% (or five mm on the visual analogue scale) representing no change in esthetics, 19 patients of surgery group were considered to have improved facial esthetics, one to have worsened esthetics, and 12 to have no change in esthetics. In the growth-modification group, 15 patients were considered to have improvement, three to have worsening, and 10 to have no change in esthetics with treatment.

DISCUSSION

The patients included in the study sample were selected on the basis of both the treatment technique and the pres-



FIGURE 1. Dot plots of esthetic scores for surgery and growth-modification groups. (a) Pretreatment scores. (b) Posttreatment costs.

TABLE 2. Esthetic Scores for Surgery and Growth-Modification Groups

		Surgery Gr	oup	Growth-Modification Group		
Esthetic Score	Mean	SD	Range	Mean	SD	Range
Pretreatment	43.7	8.1	28.3-60.3	45.9	7.2	33.6–61.1
Posttreatment	50.0	8.1	36.3-68.8	50.5	9.9	32.0-69.8
Change with treatment	6.3	7.9	-7.8-28.0	4.6	8.3	-19.3-18.2
Percent change with treatment	16.7	22.0	-17.4-76.8	10.5	17.4	-36.0-39.8

TABLE 3. Number of Patients With Positive and Negative Change in Attractiveness

Esthetic Change	Surgery Group	Growth-Modification Group
Esthetically		
Improved (>0)	22	21
Worsened (<0)	10	7
Esthetically		
Improved (>5%)	19	15
Worsened (>5%)	1	3
No change (in either di- rection ≤5%)	12	10

ence of a Class II division 1 malocclusion, as measured with the ANB angle and the incisal overjet. The fact that there were no statistically significant differences in the pretreatment ANB angle and overjet for the two groups indicates that the degree of dentoskeletal dysplasia was similar for both.

Despite having similar anteroposterior discrepancies, different treatments had been chosen, apparently largely because of different potentials for growth. As would be expected, the patients in the surgery group were significantly older than those in the growth-modification group. Had all the patients in the surgery group presented at an age when clinically useful facial growth remained, some may have been managed reasonably with growth-modification techniques. It seems, therefore, that within this study sample, a particular patient's developmental status had played a major part in the choice of Class II treatment modality.

The average duration of overall active treatment was significantly greater for the growth-modification group (4.1 years) than for the surgery group (2.7 years). These figures would suggest then that most surgical treatment plans would be completed in a somewhat shorter time than those relying on considerable growth for successful treatment. Despite the generally shorter treatment duration for the patients in the surgery group, the advantages gained with the shorter duration must be assessed alongside the likely morbidity and potential risks associated with orthognathic surgery.

The fact that, on average, facial esthetics improved with Class II treatment, regardless of the method used, would support the findings of previous studies, in which esthetic outcomes in Class II patients treated by either surgery^{24–26} or by camouflage treatment^{22,35} were generally considered to have been favorable. It is clear, however, from the results of this and the other studies that perceived facial esthetics could improve, worsen, or remain the same, whether the Class II problem is managed with or without orthognathic surgery. It is also interesting, in this study, that some of the differences in pre- and posttreatment scores were so close to zero that, in effect, they represented no change at all in esthetics with treatment because such small values would be beyond the discriminatory ability of the judges.³²



FIGURE 2. Patient TJ. (a) Before surgical mandibular advancement. (b) After surgical mandibular advancement: perceived as favorable esthetic outcome. (c) Lateral cephalometric superimposition on sella-nasion at sella.

The records of four individual patients presented in Figures 2 through 5 highlight the fact that both the orthognathic surgery and the attempted growth-modification techniques may lead to either favorable or unfavorable esthetic outcomes. Patient TJ (Figure 2), for instance, underwent a mandibular advancement and was widely perceived to have an increase in facial attractiveness. On the other hand, patient SM (Figure 3), who also underwent a surgical mandibular advancement, was generally considered to be less attractive after treatment. Similarly, in the attempted growth-modification group, patient AB (Figure 4) had a favorable esthetic treatment outcome, but patient AG (Figure 5) was perceived to have had an unfavorable esthetic outcome.

Previous work has suggested that Class I skeletal patterns are perceived to be more attractive than Class II patterns.^{33,36–38} Furthermore, measures of anteroposterior dental discrepancy, especially incisal overjet, seem to be related to the perception of facial attractiveness, with those subjects having the greatest anteroposterior discrepancy more likely to be considered less attractive.³⁹ This would be supported by the finding in the present study that facial esthetics was generally seen to improve with Class II treatment, as the measures of anteroposterior dentofacial discrepancy de-



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FIGURE 3. Patient SM. (a) Before surgical mandibular advancement. (b) After surgical mandibular advancement: perceived as unfavorable esthetic outcome. (c) Lateral cephalometric superimposition on sella-nasion at sella.

creased. It should be realized, however, that although facial balance, harmony, and attractiveness are all related in some degree to the underlying skeletal and dental pattern of the individual, these relationships are not absolute.⁴⁰

It might be argued that comparing the esthetics and esthetic changes in the surgical and growth-modification groups is not valid because of the significant difference between the average ages of the patients in the two groups. It is, for instance, accepted that an increase in age seems to be correlated with some reduction in facial attractiveness.^{41,42} This natural reduction in esthetics with age may possibly have influenced the various esthetic assessments in this study. Because there were no significant differences in either pre- or posttreatment mean esthetic scores for the two groups, it is suggested that factors other than age alone may have influenced the perception of facial attractiveness.

Overall, it seems that if a Class II division 1 patient presents early enough for some sort of attempted growth-modification treatment, it may be possible for the esthetic outcome of that treatment to be just as favorable as if that patient were to be treated later at the end of the growth phase by orthognathic surgery.⁴³ However, only average findings have been reported in this study, and many clinical and cephalometric factors need to be considered when planning treatment for each individual Class II patient. It may, for instance, be reasonable to provide some form of attempted growth-modification treatment for those patients, in whom there is doubt about the ultimate choice of treat-



FIGURE 4. Patient AB. (a) Before attempted growth-modification treatment. (b) After attempted growth-modification treatment: perceived as favorable esthetic outcome. (c) Lateral cephalometric superimposition on sella-nasion at sella.

ment method, knowing that in not all patients will such attempted growth-modification be successful. In these cases, patients may have to receive treatment later in the form of orthodontics combined with orthognathic surgery. The need for such treatment later perhaps should not be seen as a failure but more as a recognition of the wide range of individual responses to any form of orthodontic or orthopedic treatment.

CONCLUSIONS

On the basis of the findings of this study, the following conclusions can be drawn:

- Facial esthetics of Class II division 1 patients generally improves with treatment of the Class II dental problem. There is, however, wide individual variation in the esthetic improvement, with some patients being perceived as actually having a worsened facial appearance as a result of treatment.
- Perceived esthetic outcomes in many Class II division 1 patients seem to be just as favorable, whether they have been managed earlier during the useful growth phase or later, at the completion of growth by orthognathic surgery.
- Most combined orthodontic-orthognathic surgery treatments seem to be completed in somewhat shorter overall



FIGURE 5. Patient AG. (a) Before attempted growth-modification treatment. (b) After attempted growth-modification treatment: perceived as unfavorable esthetic outcome. (c) Lateral cephalometric superimposition on sella-nasion at sella.

active treatment times than those relying on considerable growth, growth modification, or tooth movements for successful treatment.

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