

REVIEW ARTICLE

Orthodontic Camouflage in Skeletal Class III Malocclusion: A Contemporary Review

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ABSTRACT

Early orthopedic intervention can be effective in normalizing skeletal class III malocclusions if patients are treated in a timely manner. There are a large number of skeletal class III patients that either decline or cannot afford surgical treatment. The only alternative is 'Orthodontic camouflage' through comprehensive treatment with fixed appliances. The ultimate judgment as to whether orthodontic treatment alone, to camouflage a skeletal problem, would be an acceptable result, or whether orthognathic surgery to correct the jaw discrepancy would be required, must be made by the patient and parents. Class III camouflage logically would be the reverse of class II camouflage, based on retracting the lower incisors, advancing the upper incisors, and surgically reducing the prominence of the chin, in addition, rotating the mandible downward and backward, when the chin is prominent, can be considered a form of camouflage. Even though timing of orthodontic treatment has always been somewhat controversial, it is an agreement in the literature that prognosis is still obscure until growth is completed. A cephalometric analysis is needed to quantitatively record the severity of the class III malocclusion and to determine the underlying cause of the deformity. Although it is agreed that camouflage line of treatment is not an ideal line of treatment, but it serves its purpose very well in mild range of skeletal dysplasia's and in conditions where patient is either unwilling for orthognathic surgery or in cases were surgery is contraindicated.

Keywords: Orthodontic camouflage, Skeletal Class III, Adult treatment.

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INTRODUCTION

The developing skeletal class III malocclusion is one of the most challenging problems confronting the practicing orthodontist. Early orthopedic intervention can be effective in normalizing skeletal class III malocclusion if patients are treated in a timely manner.¹⁻⁶ Class III malocclusion is a severe dentofacial anomaly. In most patients, there is no single feature responsible for the anomaly.⁷⁻¹⁴ Those with class III malocclusion frequently show combinations of skeletal and dentoalveolar components.^{15,16} Moreover, there are complex interactions of genetic and environmental factors that can act synergistically, in isolation, or in opposition.^{17,18} Compared with class I subjects, several aberrant cephalometric measurements have been reported in class III malocclusion patients, such as shorter anterior cranial base length, more acute cranial base angle, shorter and more retrusive maxilla, more obtuse gonial angle, excessive lower anterior face height, mandibular prognathism or excessive growth, more proclined maxillary incisors, and more retroclined mandibular incisors.¹⁰⁻¹⁴ Studies have also shown that no single morphologic feature indicates potential class III development. Kerr et al¹⁹ presented cephalometric criteria for classification of adult class III patients to treat them objectively. The pretreatment lateral cephalograms of patients who had either surgical or orthodontic treatment of their class III malocclusion were compared by using univariate statistical methods. Although significant differences were found between both groups in terms of ANB angle, maxillary-mandibular (M/M) ratio, mandibular incisor inclination and Holdaway's angle, in view of the complex interaction of skeletal and dentoalveolar parameters, it seems highly improbable that single variables could contain enough information to explain the anomaly.²⁰ Furthermore, univariate statistical techniques were insufficient for diagnosis, treatment planning and outcome prognosis.²¹ Therefore, recent studies have recommended a multivariate approach for analyzing the relationship between craniofacial structure and class III malocclusion.^{22,23} Based on a discriminant analysis (DA), Stellzig-Eisenhauer et al⁷ developed a formula to classify class III adults into a group that is treatable solely orthodontically and a group that requires orthognathic surgery. DA is a multivariate procedure that has

been especially designed to differentiate between 2 groups of subjects from the same population.²⁴ In the orthodontic literature, most studies with multivariate statistics explored the potential of DA.^{25,26} The determining variables in the aforementioned study were the following: Wits appraisal (Wits), length of the anterior base (S-N), M/M ratio, and lower gonial angle (G_o lower). With the multivariate model, 92% of the study patients could be classified correctly. Consequently, the DA was highly significant ($P < 0.0001$). In addition to these results, DA had previously been successfully applied to separate class III patients from class I subjects.²² Moreover, DA was used to determine the prognosis for treatment outcome and relapse of orthodontically treated class III patients.^{23,27} In the study of Schuster et al,⁸ multivariate procedures were used to identify the dentoskeletal variables that provide the best differentiation between prepubertal children with class III malocclusion who could be adequately treated by orthopedic or orthodontic therapy alone and those who required orthognathic surgery. The models were highly significant, classifying 93.2 to 94.3% of the patients correctly. In the studies of Stellzig-Eisenhauer et al⁷ and Schuster et al,⁸ the Wits appraisal was the most predictive variable for differentiating between nonsurgery and surgery patients. However, the results of the former studies should be regarded critically. Although multivariate techniques are better than univariate ones, their limitations include the following: for a sufficiently stable model that also applies to patients outside the study, a large sample size is a prerequisite, and the selection of parameters might not include all variables required to accurately differentiate the groups.^{20,22,25} Stellzig-Eisenhauer et al⁷ could correctly allocate 97.7% of the solely orthodontically treated adults with class III malocclusion. Those who required orthognathic surgery could be classified in 86.4% of the cases; only 2.3% of the nonsurgery patients were misclassified, but 13.6% of those who needed orthognathic surgery were misclassified. These findings led to the hypothesis that, especially in borderline surgical patients, additional factors are responsible for the necessity of surgical intervention. Because class III patients frequently show skeletal deviations in the transverse dimension, the predictive value of the multivariate model might improve if transverse components are included.^{7,8} However, there are a significant group of patients who either do not have an opportunity to receive early treatment or are corrected during childhood with significant relapse during the adolescent growth spurt. In addition, there are a large number of skeletal class III patients that either decline or cannot afford surgical treatment. The only alternative is ‘Orthodontic camouflage’ through comprehensive treatment with fixed appliances.

WHAT IS CAMOUFLAGE?

The word camouflage comes from a French word ‘camoufler’ meaning ‘to blind or veil’. Camouflage means to disguise an object, in plain sight, in order to conceal it from something and someone.

CAMOUFLAGE IN ORTHODONTICS

Beyond the adolescence growth spurt, even though some facial growth continues, too little remains to correct skeletal problem. The possibility of treatment therefore is either displacement of teeth relative to their supporting bone, to compensate for the underlying jaw discrepancy or surgical repositioning of jaw. Camouflage treatment is defined by Proffit²⁸ as displacement of the teeth relative to their supporting bone to compensate for an underlying jaw discrepancy. Thus, camouflage in orthodontics is defined as ‘implementation of a less intensive treatment plan option in a patient with a severe problem so as to obtain optimum results within physiologic limits and which may not be addressing the correction of the actually existing problem in the patient.’

Classification of camouflage is:

1. Orthodontic camouflage
 - Class II camouflage
 - Class III camouflage
 - Camouflage of asymmetry
 - Camouflage of skeletal open bite
2. Surgical camouflage
 - Chin surgery
 - Nasal surgery
 - Facial soft-tissue procedures
 - Single jaw surgery in patient with double jaw problems

Computer imaging in the decision for camouflage vs orthognathic surgery.²⁸

The ultimate judgment as to whether orthodontic treatment alone, to camouflage a skeletal problem, would be an acceptable result, or whether orthognathic surgery to correct the jaw discrepancy would be required, must be made by the patient and parents. The orthodontist’s role is to supply the information they need to make the decision and in that context, computer image predictions of the outcome without and with surgery are an important tool to help the patient and parents understand. For the doctor, there are two possible attitudes toward the use of computer predictions; this is dangerous because the predicted outcome may not be obtained, or this is excellent because it improves communication with patients so that they really understand the options that are being offered. Patients appreciate the improved communication that the computer predictions make possible, and compared to those who did not see their predictions are more likely to be satisfied with the outcome of treatment.

Class III Camouflage

Class III camouflage is more difficult than its class II counterpart, not because the tooth movement is more difficult but because it is more difficult to obtain acceptable esthetics. The problem is that most class III patients already have some dental compensation that developed during growth. Typically, the upper incisors are at least somewhat proclined and protrusive relative to the maxilla, whereas the lower incisors are upright and retrusive relative to the chin. Class III camouflage logically would be the reverse of class II camouflage, based on retracting the lower incisors, advancing the upper incisors, and surgically reducing the prominence of the chin, in addition, rotating the mandible downward and backward, when the chin is prominent, can be considered a form of camouflage. The common problems and difficulties in class III camouflage are listed in Table 1.

In order to correct an anterior crossbite, with orthodontics alone, further protraction of the upper incisors and retraction of the lower incisors would be necessary. As upper incisors are tipped forward, their inclination becomes an esthetic problem, but torquing the roots forward is difficult and stresses the anchorage. For all practical purposes, labial root torque to the upper incisors means that more retraction of the lower incisors is necessary. That compounds the biggest problems with orthodontic camouflage; retracting the lower incisors tends to accentuate the prominence of the chin, not camouflage it. Unless the lower incisors are protrusive to start with, little if any retraction is acceptable esthetically.

Malocclusions with a mild mandibular prognathism and a moderate overbite can be corrected by dentoalveolar movements. Class III elastics, with or without extraction of teeth, have been used to camouflage the skeletal discrepancy, resulting in an acceptable facial profile. Class III cases with mild mandibular prognathism and crowding can be treated by various extraction schemes including four premolars (maxillary second premolars and mandibular first premolars), two lower premolars (mandibular second or first premolars) or a mandibular incisor.²⁸

If this corrects the dental occlusion but does not camouflage the facial deformity, there are two possibilities for additional surgical camouflage; onlay grafts to the anterior maxilla and reduction genioplasty. If there is a mandibular displacement between Cr and Co, this needs to be identified and accurately recorded at the record taking appointment. Displacements can be a major factor in determining a surgical vs a nonsurgical decision for some patients.²⁹

Indications for Class III Camouflage Treatment²⁸

- Too old for successful growth modification
- Mild to moderate skeletal class III

- Reasonably good alignment of teeth (so that the extraction spaces would be available for controlled anteroposterior displacement and not used to relieve crowding).
- Good vertical facial proportions, neither extreme short face nor long face.

Contraindications for Class III Camouflage Treatment²⁸

1. Moderate or severe class III and vertical skeletal discrepancies.
2. Patients with severe crowding or protrusion of incisors, in whom space created by extractions will be required to achieve proper alignment of the incisors.
3. Adolescents with good growth potential (in whom growth modification should be tried first) or nongrowing adults with more than mild discrepancies (in whom orthognathic surgery usually offers better long-term results).
4. Medically compromised patients.
5. Mentally retarded patients.
6. Periodontally compromised patients.
7. Need for immediate results (marriageable age).

Diagnostic Indicators in Class III Camouflage

The differential diagnosis in skeletal class III malocclusions plays a major role in the success of treatment results. Even though timing of orthodontic treatment has always been somewhat controversial, it is an agreement in the literature that prognosis is still obscure until growth is completed. Variations in magnitude and expression of class III malocclusion can present with some difficulty during diagnosis. For example, a patient may present with

Table 1: Difficulties in class III camouflage

<i>Class III (Common Problem)</i>	<i>Orthodontic Treatment</i>	<i>Limitation</i>
Anterior cross bite	Protraction of upper(u) incisors	Further proclination of upper incisors becomes an esthetic problem
	Retraction of lower(l) incisors	Tends to accentuate the prominence of chin
Class III Malocclusion	Extraction of lower first premolar	Almost always produces esthetically undesirable results, despite the good occlusion achieved. Chin is made more prominent
	Extraction of lower second premolar	Difficult to close the extraction spaces
	Extraction of one of the lower incisors	Limited improvement in anterior occlusion

a combination of one or more dentofacial deformities, such as true mandibular prognathism or maxillary retrognathism. In order to differentiate the underlying cause of a class III malocclusion, a simplified method of evaluating patients must be utilized. Several authors have made the following recommendations in the assessment of class III patients. First, it is important to question both the patient and his/her parents about the presence of a large jaw or anterior crossbite among their family members. If a close relative required orthognathic surgery, this should alert the clinician to the probability that the patient under examination may also exhibit a severe skeletal discrepancy. Second, assess the presence of a functional shift. The relationship of maxilla to mandible should be evaluated to determine whether a discrepancy exists between centric relation and centric occlusion. Anterior repositioning of the mandible may be due to abnormal tooth contact that forces the mandible forward. These patients tend to present with a class I skeletal pattern, normal facial profile and class I molar relation in centric relation, but a class III skeletal and dental pattern in centric occlusion. Early correction of this 'pseudo' class III condition may provide for a more favorable environment for future growth. Third, a panoramic and lateral cephalometric radiograph is required to complete the diagnosis and assist the clinician in treatment planning. A cephalometric analysis is needed to quantitatively record the severity of the class III malocclusion and to determine the underlying cause of the deformity. Common predictors of successful class III camouflage used to evaluate the maxillary and mandibular position include

- ANB-(less than -2 to -3 mm)
- Wits appraisal (-2 to -6 could be treated nonsurgically)
- Linear measurements of Condylion to A point and Condylion to Gnathion,
- Percentage of midfacial length/mandibular length ratio (Co-A/Co-Gn)
- The net sum difference between maxillary and mandibular lengths, the mandibular ramus height/mandibular body length ratio, and the gonial angle. Lastly, clinical assessment may be the most important evaluation for the diagnosis when the objective of treatment planning is to optimize facial esthetics.

CAMOUFLAGE TREATMENT OF SKELETAL CLASS III

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If there is a mandibular displacement between centric relation and centric occlusion, this needs to be identified and accurately recorded at the record taking appointment. Displacements can be a major factor in determining a surgical vs a nonsurgical decision for some patients.⁴

There are several methods of conventional cephalometric analyses to assess A/P skeletal discrepancy. The Arnett analysis uses a true vertical line as a facial reference and it is recommended as a more sophisticated and accurate method of deciding the needs of the case.

Class III patients with mild to moderate class III skeletal patterns with a growth treatment response vector (GTRV) ratio between 0.33 and 0.88 can be successfully camouflaged with orthodontic treatment. Class III patients with excessive mandibular growth and a GTRV ratio below 0.38 should be warned of the need for future orthognathic surgery.³⁰

CONCLUSION

Although we all agree that camouflage line of treatment is not an ideal line of treatment, but it serves its purpose very well in mild range of skeletal dysplasia's and in conditions where patient is either unwilling for orthognathic surgery or in cases were surgery is contraindicated. In these cases camouflage treatment serves as a blessing because it helps the orthodontist to enhance patient's self-esteem, esthetics and function. However, proper diagnosis and the establishment of realistic treatment objectives by the clinician and the patient are necessary to prevent undesirable sequel in camouflaging a mild to moderate skeletal class III malocclusion.

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