Compromised nonsurgical treatment of a patient with a severe Class III malocclusion

Eric B Lowenhaupt

Abstract: This case report describes the orthodontic diagnosis and treatment of a 13y10m Caucasian female who presented with a severe Class III malocclusion, maxillary arch crowding with a crossbite of the posterior and anterior teeth. Treatment options included orthognathic surgery, extraction of maxillary first premolars, extraction of a lower incisor tooth, non-extraction, and or a combination of the above. For numerous reasons a limited non-extraction treatment was selected.

Introduction

The frequency of Class III malocclusions has been reported to be from 1-4% in the Caucasian population[1]. The etiology of Class III malocclusions may involve heredity factors[2], environmental influences[3] and even pathology. Additionally, Class III patients typically have more, longer and more unpredictable facial growth.[4] However, irregardless of the etiology all Class III malocclusions are not the same. Class III patients can have varying degrees of dental and skeletal abnormalities. An accurate diagnosis is important in revealing the underling components of the malocclusion in order to insure that the treatment plan is directed at correcting these various components. Critical areas of concern include the sagittal position of the maxilla and the mandible relative to each other and to cranial base, vertical skeletal and dental components, the positions of anterior teeth and the warping of the dentoalveolus, and the presence or absence of a centric slide (centric relation to centric occlusion). Careful evaluation of these factors can produce a detailed diagnosis which provides the clinician with the best treatment alternatives.

Diagnosis and Etiology

A 13y10m Caucasian female presented for orthodontic evaluation. She had no other siblings and her parents were divorced. There was no history of familial Class III growth. She did not have a general dentist of record and reported only one or two previous dental visits in her lifetime. She had recently seen another orthodontic practitioner who stated that there was nothing he could do for her and that she would require orthognathic surgery when she was older. A second opinion was being sought.

After reviewing the health history (the patient presented with no medical problems, allergies, or prescription drug use) and after completing an initial clinical examination, complete orthodontic records were recommended for the patient and her father accepted this recommendation. Examination of the patient revealed no signs or symptoms of any temporomandibular joint dysfunction. The patient's chief complaint was that she was unhappy with the appearance of her teeth and smile to the point of being introverted and embarrassed.

Evaluation of the orthodontic records revealed the following:

Extraoral analysis (Figure 1) revealed a straight profile with moderate facial asymmetry. The lower facial third appeared to be shorter than the upper facial thirds. Intraoral (Figure 2) and model analysis (Figure 3 & Figure 4) revealed an anterior crossbite of teeth #7-#11 and a left side posterior crossbite. There was a 100% overbite with the patient in maximum occlusion. Teeth #7 and #10 were palatally positioned to teeth #6 and #11 and tooth #10 was rotated at 90 degrees. The lower arch had spacing in the bicuspid area. The right side molar was an Angle Class I in maximum occlusion and the left side was Class III. The patient also had a severe (+5mm) curve of Spee of the lower arch. Centric relation (Figure 5) revealed that the patient was able to get her anterior teeth to an end to end relationship which produced approximately a 10mm bilateral posterior openbite. When the patient went from centric relation to centric occlusion (maximum intercuspation) she demonstrated an anterior slide of approximately 6mm, a lateral slide of approximately 2mm and a vertical slide of approximately 10 mm. Gingival tissues were healthy with the exception of a very thin zone

Eric B. Lowenhaupt, D.D.S.
Diplomate, America Board of Orthodontics,
Private Practice of Orthodontics Jupiter, Florida USA.
All correspondence to Lowenhaupt@MSN.com

Figure 1: Pre-treatment facial photographs.

Figure 2: Pre-treatment intraoral photos.

Figure 3: Pre-treatment models trimmed to centric occlusion.

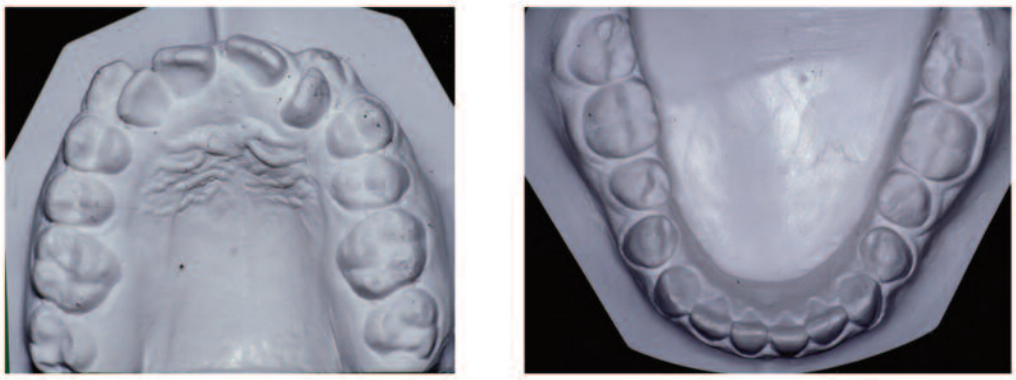

Figure 4: Occlusal photos of pretreatment models.

Figure 5: Pre-treatment centric relation.

of attached tissue on the lower anterior teeth. Oral hygiene was considered adequate. There were no sign of any dental decay or other pathology.

The panorex revealed the presence of all teeth including third molars. Condyles appeared normal, no bone or dental pathology was present and the airways appeared normal. Some mandibular asymmetry was noted.

Due to the magnitude and directions of the patient's centric slide the decision was made to record her lateral head film in both the centric position and centric occlusion position. This would then allow a better analysis of how much the skeletal and dental components contributed to the malocclusion. A modified Ricketts analysis[5] was done on each lateral head film (Figure 6 & Figure 7). The results of this analysis (Table 1) revealed the following: 1) meisocephalic facial type; 2) slight skeletal Class III based on a slightly retrognathic (to cranial base) maxilla (by one mm) and a slightly prognathic mandible (by 2 mm) resulting in a convexity of -1mm; 3) recline

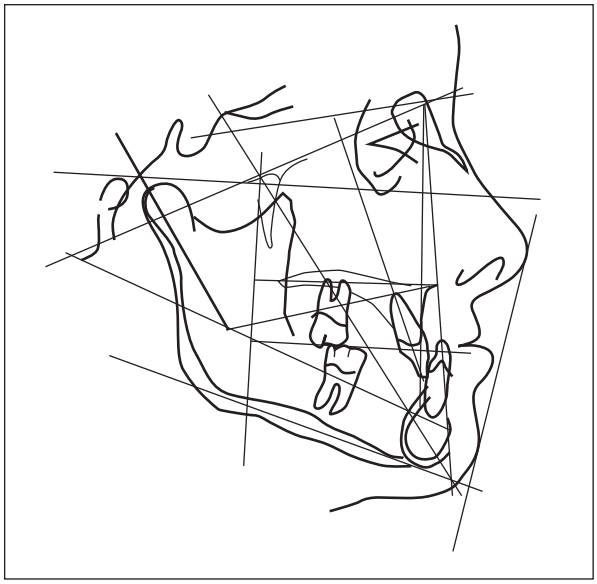

Figure 6: Pre-treatment centric occlusion tracing.

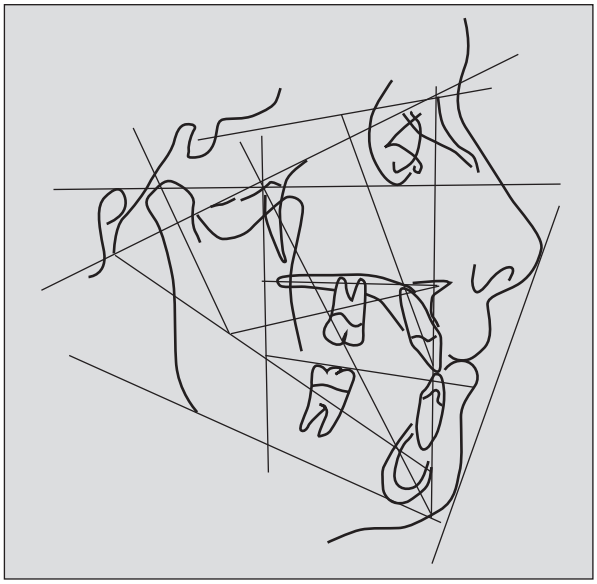

Figure 7: Pre-treatment centric relation tracing.

Table 1 Initial Ricketts analysis

	* Norms for Meso-Facial Caucasian : 9y0m		I	II	
1	Facial Axis	$90^0 \pm 3.5^0$ No △	99	90	Effected by slide
2	Low Facial Ht	$45^0 \pm 4^0$ No △	37	46	Effected by slide
3	Tot Facial Ht	$60^0 \pm 3^0$ No △	48	60	Effected by slide
4	Mand Plane	$26^0 \pm 4.5^0$ △- 1^0 q2y	17	24	Effected by slide
5	Mand Form (Arc)	$26^0 \pm 4^0$ △+ 1^0 q2y	35	34	
	Vertical Indicators				
6	Palatal Plane	$+1^0 \pm 3.5^0$ No △	+1	0	
7	F. Occ. Plane	$-11^0 \pm 2^0$ △+ 3^0 total	+1	-7	Effected by slide & vertical closure
8	Mand Arc	$26^0 \pm 4^0$ △+ 1^0 q2y	35	34	
9	Mand Plane	$26^0 \pm 4.5^0$ △- 1^0 q3y	17	24	
10	Post. Facial. Ht	55mm ± 3mm △+ 1.8q1y	65	67	
	Class II & III Skeletal Factors				
11	Convexity	2mm ± 2 - 1mm q3y	-6	0	Effected by slide
12	Mand Arc	$26^0 \pm 4^0$ △+ 1^0 q2y	35	34	
13	Ramus position	$76^0 \pm 3^0$ No △	82	76	Effected by slide
14	Cranial Deflec	$27^0 \pm 3^0$ No △	26.5	26.5	
15	Cranial Length	55mm ± 2.5 + 0.8qy	55	56	
16	Corpus length	65mm ± 2.7/△+ 1.6 qy	73	72.5	
17	Porion Location	-39mm ± 2.2mm	-42	-42	
18	Facial Depth	$86.5^0 \pm 3^0$ △+ 1^0 q3y	96	89	Effected by slide
19	Max Depth	$90^0 \pm 3^0$ No △	89	89	
	Dental Factors				
20	1 to A Perp	5mm ± 2mm	+2.5	+2.5	
21	FMIA	$65^0 \pm 3.5^0$	83	76	
22	IMPA	$90^0 \pm 4.5^0$	80	80	
23	1 to A Pog	1mm ± 2mm	+5.5	+1	Effected by slide
24	6 to 6 width	34mm ± 3.0mm	34	34	
	Soft Tissue Factor				
25	Lower lip to 'E'Plane	-2mm ± 2 △- 1^0 q5y	-2	-6	

* All measures must be adjusted for age, race and facial type
I Initial centric occlusion
II Initial centric relation

lower anterior teeth; 4) severely reclined upper anterior teeth; 5) skeletal facial height in centric relationship was normal (i.e. the patient was not hyper- or hypo-divergent). Overall, the analysis revealed that the patient did not exhibit any severe Class III skeletal discrepancies and appeared to have more of a dental problem.

Treatment Objectives

The main treatment objective for this patient was to align her severely malposed upper anterior teeth and correct her occlusion (primarily her anterior crossbite). Since her skeletal problem appeared to be minimal a dental correction of her malocclusion was considered the primary goal. Esthetics, function and stability were all goals in establishing as ideal an occlusion as possible. Establishing an esthetic smile to improve overall facial esthetics and improve the patient's attitude was also a primary concern.

Treatment Plan and Alternatives

Since the patient did not have a significant skeletal discrepancy (based on the diagnostic records) the initial plan was to attempt to improve her severe dental malocclusion by utilizing fixed orthodontic appliances in a non-extraction approach. If orthognathic surgery was going to be needed at sometime in the future the dental arches would have to be aligned and the non-extraction approach was deemed the most conservative starting approach. Whether the alignment of the upper anterior teeth could be accomplished without extractions and whether the alignment of these teeth would eliminate the anterior crossbite was uncertain. Other options considered were: 1) possible extraction of a lower incisor to provide space to further retract the lower anterior dental arch and establish overjet; 2) maxillary expansion to correct the posterior crossbite and possibly aid in gaining upper arch length for alignment of the malposed teeth; 3) a combination of dental alignment of the upper and lower arches and evaluation for orthognathic surgery once facial growth was completed.

Treatment Progress

Both the patient and parent (father) had very little experience with any dental procedures. Additionally, the family's finances prevented any consideration of orthognathic

Figure 8: Initial wire with posterior acrylic bite block.

Figure 9: 8 weeks of treatment.

Figure 10: 8 weeks treatment without posterior bite block (patient is now end to end).

surgery and they could only afford the minimum of any dental or orthodontic treatment. For these reasons the simplest and most conservative treatment would begin with the attempt to align the upper anterior teeth.

Treatment was begun with the placement of upper .018 edgewise brackets and bands (Victory series MBT prescription 3M Unitek, Monrovia, California) on the upper arch (skipping over the severely malposed lateral incisors). The real problem was how to address the patient's severe anterior and vertical slides which would produce massive

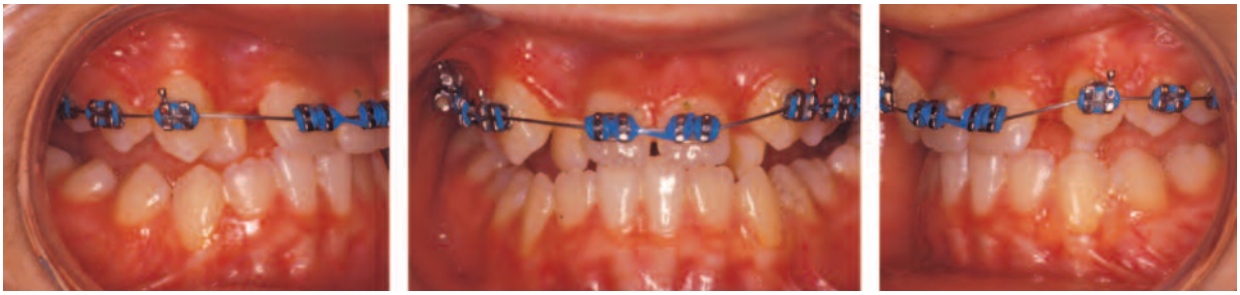

Figure 11: 16 weeks treatment.

Figure 12: 12 months treatment time.

Figure 13: 14 months treatment time.

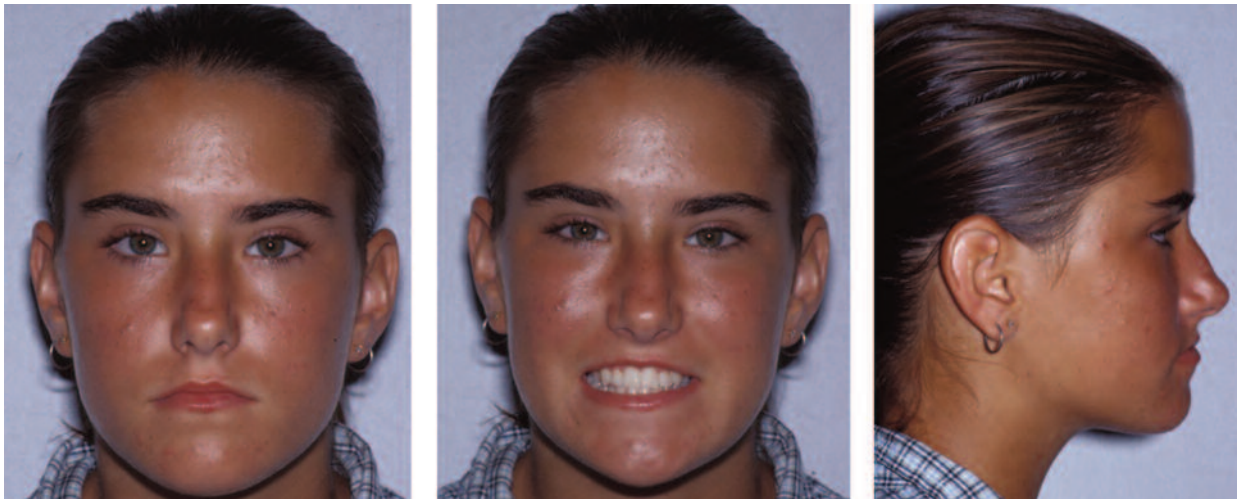

Figure 14: Finish facial photographs.

Figure 15: Finish intraoral photographs.

interferences with the brackets and make jumping the anterior bite impossible. Several options were considered but the best solution was the use of a removable posterior bite block. This bite block was made intaorally with the use of a plastic base arch (3mm thick hard plastic formed on a vacuum machine in the lab) to which cold cure acrylic was added. This appliance was then placed in the mouth to establish the proper vertical height then the appliance was cured in a pressure pot and trimmed and polished (Figure 8). Care was taken to avoid covering the lower anterior teeth so the upper anterior teeth would have room to advance without interference. This appliance would have to be worn full time including eating (remove to brush). The initial wire that was placed was a flexible .016 CuNiti wire. The patient was seen eight weeks later (Figure 9) and at that time elastic chain was placed between the upper central incisors. The occlusion was also checked without the bite block in place (Figure 10) and slight overjet was noted. The posterior bite block was reduced to reflect this new vertical position. The archwire remained the same. At 16 weeks (Figure 11) more overjet had been established, space was opening for the maxillary lateral incisors and the bite block was once again adjusted for the new vertical position. The arch wire remained the same. At 18 weeks the maxillary lateral incisors were bonded and a series of sectional wires and elastomeric chains were utilized to position these teeth and bring them out of cross bite. These brackets were also placed on the teeth upside down to reverse the torque of

Table 2 Finish Ricketts analysis

* Norms for Meso-Facial Caucasian : 9y0m			
	Facial Type Indicators		
1	Facial Axis	90° ± 3.5° No △	92
2	Low Facial Ht	45° ± 4° No △	44
3	Tot Facial Ht	60° ± 3° No △	57
4	Mand Plane	26° ± 4.5° △- 1^0 q3y	20
5	Mand Form (Arc)	26° ± 4° △+ 1^0 q2y	35
	Vertical Indicators		
6	Palatal Plane	+1° ± 3.5° No △	0
7	F. Occ. Plane	-11° ± 2° △+ 3° total	-8
8	Mand Arc	26° ± 4° △+ 1^0 q2y	35
9	Mand Plane	26° ± 4.5° △- 1^0 q3y	20
10	Post. Facial. Ht	55mm ± 3mm △+ 1.8q1y	67
	Class II & III Skeletal Factors		
11	Convexity	2mm ± 2 - 1mm q3y	-2.5
12	Mand Arc	26° ± 4° △+ 1^0 q2y	35
13	Ramus position	76° ± 3° No △	79
14	Cranial Deflec	27° ± 3° No △	27
15	Cranial Length	55mm ± 2.5 + 0.8qy	57
16	Corpus length	65mm ± 2.7/△+ 1.6 qy	74
17	Porion Location	-39mm ± 2.2mm	-41
18	Facial Depth	86.5° ± 3° △+ 1^0 q3y	93
19	Max Depth	90° ± 3° No △	90.5
	Dental Factors		
20	1 to A Perp	5mm ± 2mm	+7
21	FMIA	65° ± 3.5°	81
22	IMPA	90° ± 4.5°	79
23	1 to A Pog	1mm ± 2mm	+2
24	6 to 6 width	34mm ± 3.0mm	34
	Soft Tissue Factor		
25	Lower lip to 'E' Plane	-2mm ± 2 △- 1^0 q5y	-4
* All measures must be adjusted for age, race and facial type			

the brackets to aid in obtaining better root torque (facial root torque). At 12 months of treatment all anterior teeth were out of cross bite and the patient discontinued her bite splint at that time (Figure 12). The patient and parent decided that they were very happy with the results obtained to date but due to financial constraints were unable proceed any further with treatment. Some second order and torquing bends were placed in the wire (Figure 13) and the decision was made to discontinue treatment. After 17 months of treatment the patient was debanded (Figure 14 and Figure 15) and an upper circumferential Hawley was delivered for night time wear. At no time during or after the treatment did the patient complain of any TMJ problems.

Treatment Results

At the time treatment was discontinued the following had been accomplished: 1) the severe upper dental malalignment had been corrected: 2) the anterior and posterior cross bite had been corrected: 3) positive overbite and overjet had been created: 4) a stable posterior occlusion with minimum centric slide was established: 5) an esthetic smile was established. The soft tissue facial profile remained straight. The lateral head film (Figure 16 and Table 2) at the end of treatment demonstrated that (as suspected) most of the correction was the result of tooth movement and the dentoalveolar change of the upper anterior teeth. Superimposition of the maxilla shows that the angulations of the upper incisors were increased. Facial convexity (-2.5mm) continued to indicate a slightly Class III skeletal relationship. The skeletal changes seen would be consistent with what would be expected from facial growth. The correction of the posterior crossbite was the result of eliminating the patient's anterior dental slide. No expansion appliances were utilized in this case. The resultant dental correction would then result in a camouflage of this slight skeletal discrepancy. Clinical examination did not reveal and the patient denied any signs or symptoms of TM joint dysfunction.

Discussion

Treating Class III malocclusions requires an accurate diagnosis in order to isolate the various components of the malocclusion. Patient age, a familial history of Class III skeletal growth, and the skeletal and dental components of the malocclusion all play a role in determining the proper treatment direction. For non-growing patients or for patients approaching the end of their skeletal growth options for treatment narrow to various extraction scenarios, orthognathic surgery, or some type of dental camouflage procedure. Additionally, patient's and parent's concerns regarding the type and amount of treatment must be addressed.

Most practitioners agree that the most efficient timing for Class III skeletal problems is in the early mixed dentition (4). Unfortunately, this is not always the time that the patient presents themselves. Patients who

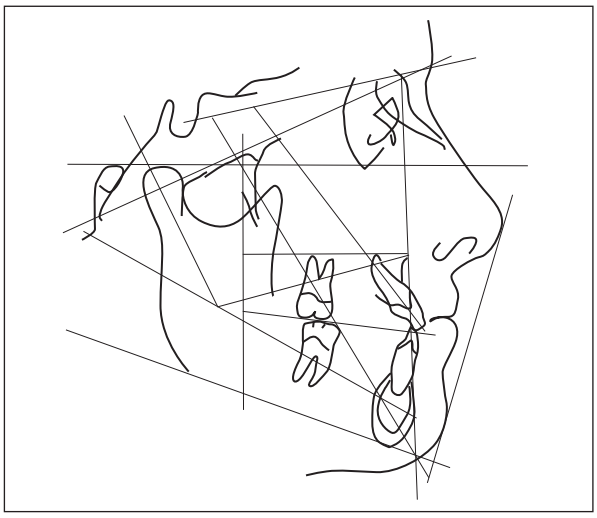

Figure 16: Finish lateral headfilm tracing.

present with Class III malocclusions with anterior crossbites can benefit from the correction of the anterior crossbite and establishment of overbite and overjet.

The treatment for this patient represents a compromise. Obviously, ideal results were not obtained. The upper lateral incisors do not have ideal facial root torque and the curve of Spee was not addressed. Additionally, despite the fact that the lower arch was not treated, the lower cuspids and incisors continue to show a very minimal (thin) zone of attached gingiva. Though this tissue level has remained fairly stable throughout treatment the need for future mucogingival periodontal treatment (including the possibility of grafts) exists.

This patient's orthodontic treatment was completed as she approached her sixteenth birthday. Though the exact age that facial growth is completed for females and the relationship between facial growth and skeletal growth is not well established, what is known is that Class III skeletal growers tend to grow longer and more unpredictably than Class I growers (4). Whether this patient will undergo a latent period of mandibular development is not known. However, the fact that there does not appear to be any familial history of Class III skeletal growth and the establishment of a more normal overbite and overjet relationship may help to inhibit further Class III skeletal changes and maintain her correction. Future treatment could involve orthognathic surgical procedures and the patient and parents would be informed of these possibilities.

The long term health and function of the TM joint is always a consideration for patients. This patient did not report any TM joint dysfunction before, during or after treatment. Egermark[6] reported that no single occlusal factor (malocclusion) is associated with a higher incidence of TM disorders. However, no patient is immune from developing TM disorders, especially (as often reported) in female patients who seem to have a higher incidence than male patients. As always patients and parents need to be aware of the potential for the development of future TM joint dysfunction and appropriate treatment for such problems may be indicated.

Overall, this was a compromise treatment with a reasonable final result. The occlusion is functional and stable and the patient's chief complaint was met in establishing a pleasing and esthetic smile. The patient's self image was greatly improved.

Conclusions

In all the 'noise' of today's orthodontic marketing the practitioner is bombarded with many different claims of appliance efficiency and effectiveness. Often these claims come accompanied by glowing clinical reports or research findings that have been vetted by the supposed experts who as it turns out are often sponsored by the same company whose products they are touting. The bottom line is that orthodontics is still about change and all orthodontic treatment involves causing a change. While many advances in technology have eased the burden of orthodontic treatment on both the practitioner and the patient it is still the process of utilizing accurate diagnosis and treatment planning based on this diagnosis that allow the orthodontic practitioner to navigate through the complex cases. Relying on a 'magic' appliance system is not necessary if the basic principals of diagnosis and biomechanics are followed. This would then explain why so many different 'systems' seem to work well and it relieves the practitioner of the worry that his or her particular 'orthodontic system' does not perform as well as some other newly marketed appliance system. The use of high quality orthodontic appliances and materials is important, however, orthodontic treatment and systems can and should be individually tailored for each patient.

The purpose of this case is to demonstrate the diagnostic criteria used to diagnose and treatment plan what (at least initially) appears to be a very serious and debilitative Class III malocclusion. With the proper diagnosis a systematic treatment plan can be formulated which then makes the actual appliance used to accomplish the treatment goals a secondary consideration. In the 'real world' ideal is not always possible. In this case the limited treatment provided produced a result that was satisfying to the patient, parent and practitioner.

References

1 Bishara, SE, Textbook of Orthodontics, W.B. Saunders Company, 2001

2 McGuigan, DG: The Hapsburgs, London, 1966, WH Allen

3 Rakosi T, Schilli W: Class III anomalies: a coordinated approach to skeletal, dental and soft tissue problems, J Oral Surg 39:860-870, 1981

4 Baccetti T et al: Skeletal effects of early treatment of Class III malocclusion with maxillary expansion and facemask therapy: Am J Ortho Dentofacial Orthop 113:333-343, 1998

5 Ricketts, RM., D.D.S., Bioprogressive Therapy , Copyright 1979, Rocky Mountain Orthodontics

6 Egermark, I, et al: A 20 Year Follow-up of Signs and Symptoms of Temporomandibular Disorders and Malocclusions in Subjects With and Without Orthodontic Treatment in Childhood: The Angle Orthodontist: Vol. 73, No 2, pp. 109-115. 2003