

# SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION COMBINED WITH MAXILLARY PROTRACTION IN AN ADULT: A PATIENT REPORT

*The aim of this article is to discuss an alternative treatment for adult patients who have a dental or skeletal Class III relationship. A 20-year-old woman presented with a dental and skeletal Class III relationship and a transverse maxillary deficiency. Surgically assisted rapid maxillary expansion was followed by maxillary protraction with a face mask and orthodontic treatment with standard edgewise technique. At the end of treatment, a Class I molar and canine relationship was attained with an adequate transverse intercuspation and improvement of the patient's facial profile. World J Orthod 2009;10:334-344.*

**Key words:** Class III, maxillary deficiency, rapid maxillary expansion, protraction, SARME

The treatment of a skeletal Class III relationship in a young (growing) patient can consist of rapid maxillary expansion (RME) and maxillary protraction with a face mask because RME disarticulates the sutures and allows orthopedic changes.<sup>1-19</sup> Because this approach is not promising in adults, camouflage or orthognathic surgery are options, depending on the severity of the anteroposterior discrepancy and the patient's preference.

When the sagittal discrepancy between maxilla and mandible is not severe, a satisfactory facial profile and a correct dental relation with camouflage treatment can be achieved. This approach often includes protrusion of the maxillary and retrusion of the mandibular anterior teeth or extraction of mandibular premolars.<sup>20-22</sup> If the skeletal discrepancy is severe, the only way to achieve a proper sagittal relationship is orthognathic surgery, in addition to maxillary advancement or mandibular setback (or a combination of the two).<sup>23</sup>

Many adult patients exhibiting a skeletal Class III relationship also present a transverse maxillary deficiency. In

this situation, a surgically assisted rapid maxillary expansion (SARME) with a total Le Fort I osteotomy is the therapy of choice. If, at the same time, the sagittal skeletal and dentoalveolar relationships are not severe, SARME can be combined with maxillary protraction by a face mask, as one would use in a growing patient. Similar procedures are described in the literature.<sup>3,24-26</sup>

This case report describes a 20-year-old woman who sought orthodontic treatment at the School of Dentistry at Pontifical Catholic University of Rio Grande do Sul, Brazil. The patient's chief complaint was the unesthetic position of her maxillary right canine and facial esthetics.

## DIAGNOSIS

Facial analysis showed a mandibular deviation to the right and an increased lower facial third (Figs 1a to 1c). The patient's facial profile was concave with retrusive lips. Her smile was unesthetic due to 6.5-mm crowding in the maxillary

Susana M. Deon Rizzato, DDS, MSD<sup>1</sup>

Luciane Macedo de Menezes, DDS, MSD, PhD<sup>1</sup>

Marcel M. Farret, DDS, MSD<sup>2</sup>

Eduardo Martinelli S. de Lima, DDS, MSD, PhD<sup>2</sup>

Rogério Belle, DDS, MSD, PhD<sup>3</sup>

Michel A. Lanes, DDS, MSD<sup>4</sup>

<sup>1</sup>Professor, Department of Orthodontics, Pontifical Catholic University, Rio Grande do Sul, Brazil.

<sup>2</sup>Graduate PhD Student, Department of Orthodontics, Pontifical Catholic University, Rio Grande do Sul, Brazil.

<sup>3</sup>Professor, Department of Oral and Maxillofacial Surgery, Pontifical Catholic University, Rio Grande do Sul, Brazil.

<sup>4</sup>Department of Orthodontics, Pontifical Catholic University, Rio Grande do Sul, Brazil.

## CORRESPONDENCE

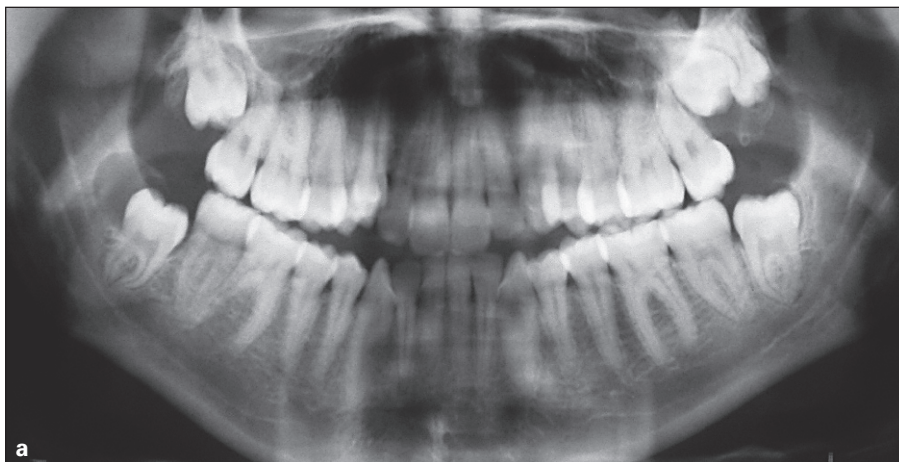
Dr Marcel Marchiori Farret  
Department of Orthodontics  
Pontifical Universidade Católica  
Av. Ipiranga 6061/6/410,  
Porto Alegre  
Rio Grande do Sul, Brazil  
Email: marcelfarret@yahoo.com.br,  
smdr@uol.com.br (Dra Susana M.D.  
Rizzato)



**Fig 1 (a to c)** Initial facial photographs showing a concave profile with retrusive lips, a mandibular deviation to the right, and an increased lower facial third. **(d to h)** Initial intraoral photographs showing 6.5 mm of crowding in the maxillary and 3 mm of crowding in the mandibular arch, a Class III molar relationship, an edge-to-edge incisor relationship, a maxillary transverse deficiency, a posterior crossbite, an open bite between the lateral incisors and the premolars on both sides, and a deviation of the maxillary midline to the right.

arch, a deviation of the maxillary midline to the right, a maxillary transverse deficiency, and a posterior crossbite (Figs 1d to 1h). Crowding in the mandibular arch amounted to 3 mm. Further, she had a Class III molar relationship, an edge-to-edge incisor relationship, and an open bite between the lateral incisors and premolars on both sides.

Pretreatment panoramic radiographs revealed that the third molars were present partially with cystic extensions of their pericoronal space; further, a fourth molar was detected on the maxillary left side (Fig 2a). The respective measurements for the lateral cephalogram (Fig 2b) are in Table 1. On the frontal cephalogram, the deviation of the mandible to the right became evident as there was an insinuation of the maxillary transverse deficiency (Fig 2c).



**Fig 2a** Initial panoramic radiograph. All third molars are present, partially with cystic extensions of their pericoronal space; further, a fourth molar is visible on the maxillary left side.



**Fig 2b** Initial lateral cephalogram.



**Fig 2c** Initial frontal cephalogram showing a deviation of the mandible to the right and hinting at a transverse maxillary deficiency.

## TREATMENT OBJECTIVES

The treatment objectives were to align all teeth, establish a normal overbite and overjet, attain a stable occlusion, correct the posterior crossbite, match the dental midlines to each other and the facial midline, and improve the patient's facial and dental appearance.

## TREATMENT OPTIONS

Three treatment options were considered. The first called for extraction of all second premolars with the intent of eliminating the crowding without much retrusion of the incisors, avoiding a flattening of the facial profile. However, as the

patient had a straight to concave profile, this option would have compromised her facial esthetics even further and was consequently rejected.

The second option was a slow expansion of the maxilla and interproximal enamel reduction (IPR) to align all teeth in both arches. This option was also disregarded because of the patient's chief complaint of facial esthetics and the risk of increasing the maxillary posterior teeth recession via expansion.

Based on the patient's concern about esthetics, SARME followed by maxillary protraction with a face mask and IPR of the mandibular posterior teeth, as well as protrusion of the maxillary and mandibular incisors, was the optimal option.

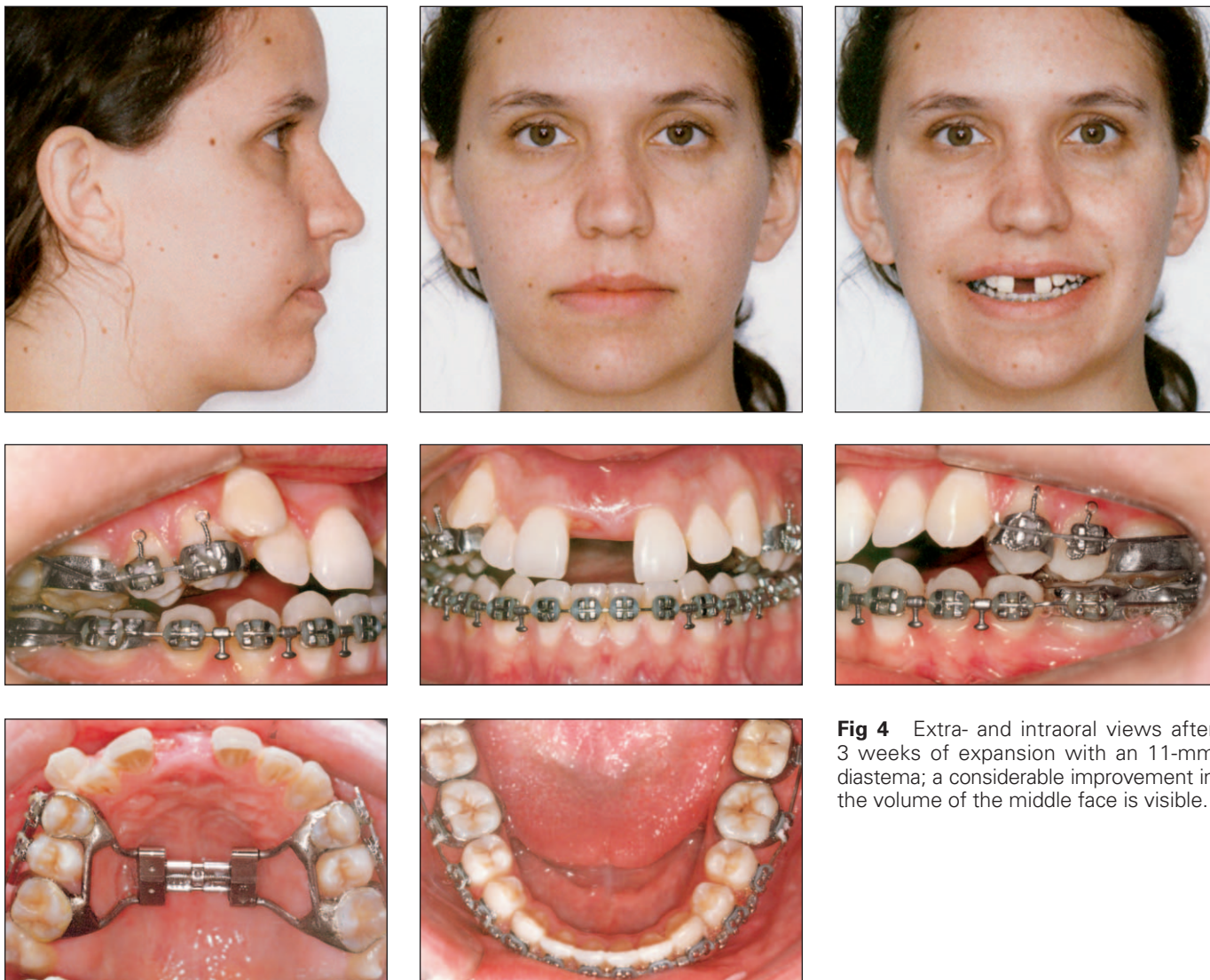


**Fig 3** Extra- and intraoral views at the beginning of treatment, starting with leveling and aligning in the mandibular arch followed by insertion of a Hyrax appliance, which was cemented on the maxillary first premolars and first molars.

## TREATMENT INITIATION

Treatment started in the mandibular arch with IPR, leveling and aligning with a slight protrusion of the incisors, and uprighting the lingually tipped posterior teeth to allow a larger expansion of the maxillary arch. Subsequently, a Hyrax appliance was cemented to the first premolars and first molars and the patient underwent surgery (Fig 3). After a week, the Hyrax appliance was activated twice daily. One week later, the first effects of

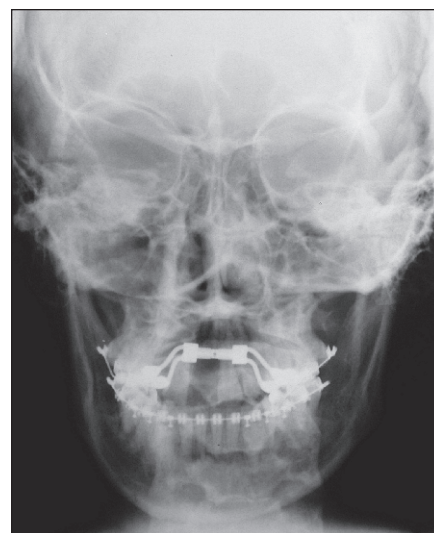
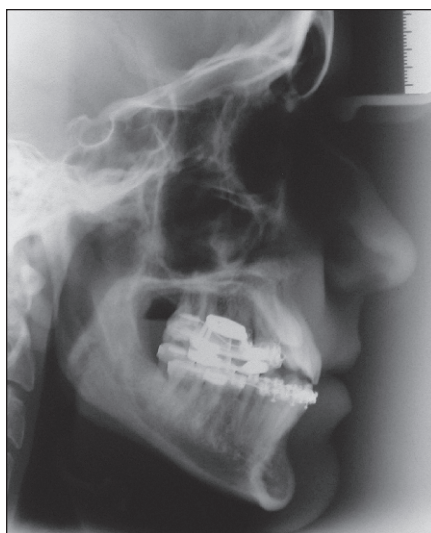
the orthopedic expansion were observed and face mask protraction was initiated. Elastics producing a force of 350 cN per side and running at a 15-degree angle downward to the palatal plane were applied 14 hours per day. The Hyrax appliance was activated for 3 weeks, until there was a transverse overcorrection. Figure 4 depicts the patient after expansion with an 11-mm diastema, revealing a considerable improvement in the volume of the middle face; the respective radiographs are shown in Fig 5.



**Fig 4** Extra- and intraoral views after 3 weeks of expansion with an 11-mm diastema; a considerable improvement in the volume of the middle face is visible.



**Fig 5** Panoramic radiograph and lateral and frontal cephalogram taken at the same time as photographs in Fig 4.

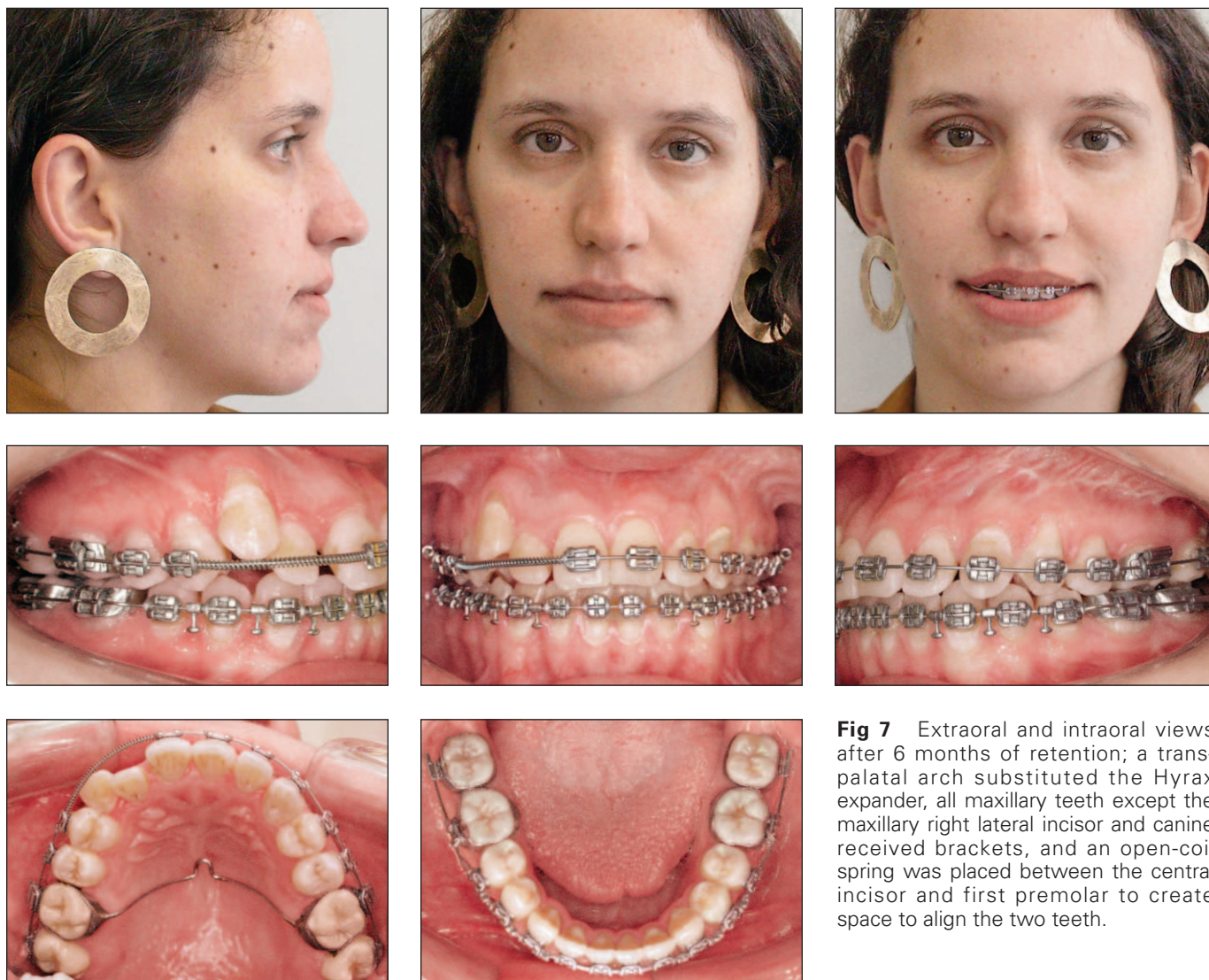




**Fig 6 (a to c)** Extraoral view after 3.5 months of maxillary protraction, considerably improved facial esthetics due to the increased volume in the middle facial third, and an increased convexity in facial profile. **(d to h)** Intraoral view with a reduced diastema and improved sagittal relationship between maxilla and mandible.

## TREATMENT PROGRESS

After 3.5 months of maxillary protraction, the facial esthetics had improved considerably due to an increased volume in the middle facial third and an increased convexity in the facial profile (Figs 6a to 6c). Intraorally, the diastema was reduced, and the sagittal relation between the two arches improved (Figs 6d to 6g).



**Fig 7** Extraoral and intraoral views after 6 months of retention; a transpalatal arch substituted the Hyrax expander, all maxillary teeth except the maxillary right lateral incisor and canine received brackets, and an open-coil spring was placed between the central incisor and first premolar to create space to align the two teeth.

After 6 months of retention, a transpalatal arch replaced the Hyrax expander and brackets were attached to all maxillary teeth (with the exception of maxillary right lateral incisor and canine) (Fig 7). The facial aspect was similar to the previous appearance. The molars and the left canine presented a Class I relationship with a good intercuspation of most posterior teeth, both midlines coincided, and

there was adequate overjet and overbite. An open-coil spring was positioned between the maxillary right central incisor and first premolar to create space. Soon after, the lateral incisor was included into the appliance, whereas the canine was slowly drawn toward the archwire so as to avoid a gingival recession.



**Fig 8** (a to c) Extraoral view at the end of treatment. Improved profile convexity is visible. (d to h) Intraoral view at the end of treatment showing good transverse relationship between both arches, normal overbite and overjet, and a Class I molar and canine relationship.

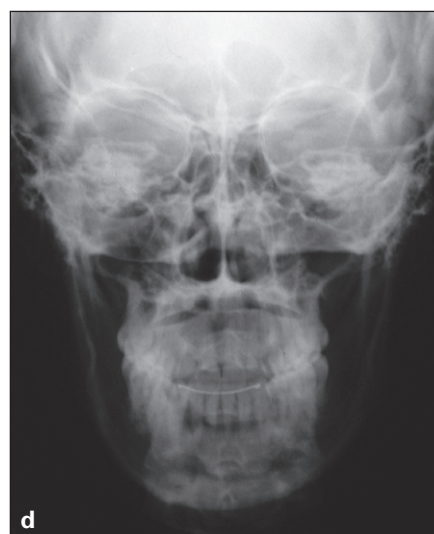
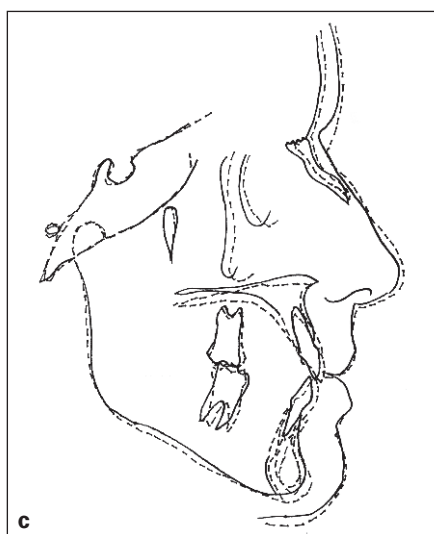
## RESULTS

At the end of treatment, the profile convexity was improved (Figs 8a to 8c). Intraorally, there was a good transverse relationship between the arches, a normal overbite and overjet, and a Class I molar and canine relationship (Figs 8d to 8h). The final panoramic radiograph

shows no root resorption but good root parallelism (Fig 9a). The final cephalograms and the superimposition are depicted in Figs 9b and 9c; the respective measurements are listed in Table 1. The frontal cephalogram reveals an adequate transverse relationship between maxilla and mandible (Fig 9d).



**Fig 9 (a)** Final panoramic radiograph revealing no root resorption and good root parallelism. **(b and c)** Final lateral cephalogram and superimposition of tracings from the initial (solid line) and final (dotted line) cephalogram. **(d)** Final frontal cephalogram revealing an adequate transverse relationship between maxilla and mandible.



**Table 1 Results of cephalometric analysis before, during, and at the end of treatment**

	Norm	Pretreatment	Postexpansion	Posttreatment
SNA (degrees)	82	76	75	75
SNB (degrees)	80	76	76	75
ANB (degrees)	2	0	-1	0
SN-GoGn (degrees)	32	39	40	40
U1-NA (degrees)	22	18	22	26
U1-NA (mm)	4	7	910	9
L1-NB (degrees)	25	22	32	23
L1-NB (mm)	4	4	6	6
U1-L1 (degrees)	131	140	128	134
IMPA (degrees)	93	85	92	87
FMA (degrees)	25	29	28	27
FMIA (degrees)	62	66	60	66

## DISCUSSION

A Class III malocclusion may be characterized by maxillary retrognathism, present in about 60% of the affected patients; mandibular prognathism, found in 20%; or a combination of the two.<sup>2,4,6-9,11</sup> In patients who have excessive mandibular length, the prognosis in growing individuals is especially unfavorable because it is very difficult to foresee and control mandibular growth. However, with maxillary retrognathism, the prognosis in growing patients is quite favorable because excellent stable results can be obtained with RME followed by protraction with a face mask.<sup>2,6-9,11,12,16,27</sup>

In patients with primary or mixed dentitions, RME promotes the disarticulation of the sutures around the maxillary region and an intensification of cellular activity.<sup>1,6,15,19</sup> However, in adult patients, suture release is no longer possible and protraction also becomes unviable.

In such a situation, it is difficult to determine whether camouflage is still indicated or if orthognathic surgery is preferable. The patient presented here was in this borderline range because she had a Class III molar/canine relationship and a concave facial profile. According to the Wits appraisal, she was skeletally Class III, though the Steiner analysis indicated a Class I relationship. Most of her findings spoke in favor of orthognathic surgery. On the other hand, this patient also had a transverse maxillary deficiency, which required an expansion. In adults, such an expansion usually requires a total Le Fort I osteotomy by which the entire maxilla is released to make protraction with a face mask possible. However, in this patient, an anteroposterior change of the maxillary region was not evident. The esthetic improvement of the profile had to be attributed to the protrusion and extrusion of the maxillary anterior teeth as to a general protraction of the maxillary dentition. A long period of retention was necessary to avoid relapse.

The results obtained in this individual prove that in situations with minor dental and skeletal discrepancies but transverse and anteroposterior maxillary deficiencies,

SARME and maxillary dentoalveolar protraction is a viable treatment alternative. This allows dissolving the existing crowding, avoiding extractions, correcting cross-bites, and improving facial appearance.

## CONCLUSION

In patients with a mild Class III discrepancy, camouflage treatment with only maxillary osteotomy and protraction is feasible. The accomplished results are esthetically and functionally satisfying and also help to prevent extractions and orthognathic surgery.

## ACKNOWLEDGMENTS

The authors would like to thank colleagues Guilherme Thiesen, Janara Feldens, and Maira Massua for their contribution in diagnosis, planning, and treatment of this patient.

## REFERENCES

1. Hata S, Itoh T, Nakagawa M, et al. Biomechanical effects of maxillary protraction on the craniofacial complex. *Am J Orthod Dentofacial Orthop* 1987;91:305-311.
2. Turley PK. Orthopedic correction of Class III malocclusion with palatal expansion and custom protraction headgear. *J Clin Orthod* 1988;22:314-325.
3. Roberts CA, Subtelny JD. An American Board of Orthodontics case report. Use of the face mask in the treatment of maxillary skeletal retrusion. *Am J Orthod Dentofacial Orthop* 1988;93:388-394.
4. Mermigos J, Full CA, Andreasen G. Protraction of the maxillofacial complex. *Am J Orthod Dentofacial Orthop* 1990;98:47-55.
5. Popp TW, Gooris CGM, Schur JA. Nonsurgical treatment for a Class III dental relationship: A case report. *Am J Orthod Dentofacial Orthop* 1993;103:203-211.
6. Ngan P, Hägg U, Yiu C, Merwim D, Wei S. Soft tissue and dentoskeletal profile changes associated with maxillary expansion and protraction headgear treatment. *Am J Orthod Dentofacial Orthop* 1996;109:38-49.
7. Shanker S, Ngan P, Wade D, et al. Cephalometric A point changes during and after maxillary protraction and expansion. *Am J Orthod Dentofacial Orthop* 1996;110:423-430.

8. Williams MD, Sarver DM, Sadowsky PL, Bradley E. Combined rapid maxillary expansion and protraction facemask in the treatment of Class III malocclusions in growing children: A prospective long-term study. *Semin Orthod* 1997; 3:265–274.
9. Ngan P, Hägg U, Yiu C, Wei SHY. Treatment response and long-term dentofacial adaptations to maxillary expansion and protraction. *Semin Orthod* 1997;3:255–264.
10. Merwin D, Ngan P, Hägg D, Yiu C, Wei SHY. Timing for effective application of anteriorly directed orthopedic force to the maxilla. *Am J Orthod Dentofacial Orthop* 1997;112:292–299.
11. Pangrazio-Kulbersh V, Berger J, Kersten G. Effects of protraction mechanics on the mid-face. *Am J Orthod Dentofacial Orthop* 1998; 114:484–491.
12. Ngan P, Yiu C, Hu A, Hägg U, Wei SHY, Gunel E. Cephalometric and occlusal changes following maxillary expansion and protraction. *Eur J Orthod* 1998;20:237–254.
13. da Silva Filho OG, Magro AC, Capelozza Filho L. Early treatment of the Class III malocclusion with rapid maxillary expansion and maxillary protraction. *Am J Orthod Dentofacial Orthop* 1998;113:196–203.
14. Suda N, Ishii-Suzuki M, Hirose K, Hiyama S, Suzuki S, Kuroda T. Effective treatment plan for maxillary protraction: Is the bone age useful to determine the treatment plan? *Am J Orthod Dentofacial Orthop* 2000;118:55–62.
15. Saadia M, Torres E. Sagittal changes after maxillary protraction with expansion in Class III patients in the primary, mixed, and late mixed dentitions: A longitudinal retrospective study. *Am J Orthod Dentofacial Orthop* 2000;117: 669–680.
16. Ngan P, Yiu C. Evaluation of treatment and posttreatment changes of protraction facemask treatment using the PAR index. *Am J Orthod Dentofacial Orthop* 2000;118: 414–420.
17. Keles A, Tokmak EÇ, Erverdi N, Nanda R. Effect of varying the force direction on maxillary orthopedic protraction. *Angle Orthod* 2002;72:387–396.
18. Ngan P. Biomechanics of maxillary expansion and protraction in Class III patients. *Am J Orthod Dentofacial Orthop* 2002;121: 582–583.
19. Cha KS. Skeletal changes of maxillary protraction in patients exhibiting skeletal Class III malocclusion: A comparison of three skeletal maturation groups. *Angle Orthod* 2003;73:26–35.
20. Costa Pinho TM, Ustrell Torrent JM, Correia Pinto JGR. Orthodontic camouflage in the case of a skeletal Class III malocclusion. *World J Orthod* 2004;5:213–223.
21. Proffit WR, White RP. *Surgical-Orthodontic Treatment*. St Louis: Mosby, 1991.
22. Litton SF, Ackermann LV, Isaacson RJ, Shapiro BL. A genetic study of Class 3 malocclusion. *Am J Orthod* 1970;58:565–577.
23. Gelgör IE, Karaman AI. Non-surgical treatment of Class III malocclusion in adults: Two case reports. *J Orthod* 2005;32:89–97.
24. Ahn JG, Figueroa AA, Braun S, Polley JW. Biomechanical considerations in distraction of the osteotomized dentomaxillary complex. *Am J Orthod Dentofacial Orthop* 1999;116:264–270.
25. Figuerroa AA, Polley JW. Management of severe cleft maxillary deficiency with distraction osteogenesis: Procedure and results. *Am J Orthod Dentofacial Orthop* 1999;115:1–12.
26. Polley JW, Figueroa AA. Management of severe maxillary deficiency in childhood and adolescence through distraction osteogenesis with an external, adjustable, rigid external distraction. *J Craniofac Surg* 1997;8:181–185.
27. Franchi L, Baccetti T, McNamara JA. Postpubertal assessment of treatment timing for maxillary expansion and protraction therapy followed by fixed appliances. *Am J Orthod Dentofacial Orthop* 2004;126:555–568.