New perspectives in the orthopedic approach to Class III treatment

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CLASS III MALOCCLUSION: A SERIOUS CHALLENGE IN DENTOFACIAL ORTHOPEDICS

FUNDAMENTAL CONCEPT # 1

Success in Class III Treatment = We need to make any effort to treat the malocclusion effectively, with attention to evidence-based treatment protocols and timing

The clinician must monitor the patient all throughout the growing period „Relapse is behind the corner...”

Because growth in Class III Malocclusion is not helping at all !!!

Early Mixed Dentition

Permanent Dentition

Skeletal Class III malocclusion has a significant genetic component

Charles V Philip IV Charles II
Class III malocclusion is a polygenic disorder that results from an interaction between susceptibility genes and environmental factors. These susceptibility genes are located in chromosomal loci.

Rabie et al. have identified erythrocyte membrane protein band 4.1 (EPB41) to be a new positional candidate gene that might be involved in susceptibility to mandibular prognathism.

Class III Malocclusion is not helping at all!!!

1. The amount of growth in subjects with Class III Malocclusion is significantly different than in subjects with normal occlusion (unfavorable).

2. In subjects with Class III Malocclusion, the peak in mandibular growth occurs later in development and lasts longer than in subjects with normal occlusion.

Longitudinal observations on 22 untreated Caucasian subjects with Class III malocclusion

<table>
<thead>
<tr>
<th>Age</th>
<th>Prepubertal (CS 1 or CS 2)</th>
<th>Postpubertal (CS 5 or CS 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>8 years and 8 months</td>
<td>15 years and 2 months</td>
</tr>
</tbody>
</table>

Baccetti T. and Franchi L., CGS Series 2004

Cervical Vertebral Maturation Method

The Cervical Vertebral Maturation (CVM) method for the assessment of optimal treatment timing in dentofacial orthopedics

Tiziano Baccetti, DDS, PhD, Lorenzo Franchi, DDS, PhD, and James A. McNamara Jr, DDS, PhD

(Seminars in Orthodontics 2005;11:119-129)
Midfacial Length

Growth Increments (time interval: 6 ys and 6 mos)

- 2 mm
+ 4 mm

Class III
Class I *

(from Bhatia and Leighton, 1993)

(matched for radiographic enlargement = 8%)

Mandibular Length

Growth Increments (time interval: 6 ys and 6 mos)

+ 4 mm

Class III
Class I *

(from Bhatia and Leighton, 1993)

(matched for radiographic enlargement = 8%)

Class III vs. Class I
Excessive Growth of the Mandible with reference to the Maxilla in the Circumpubertal Period: 6 mm

Excessive Growth of the Mandible with reference to the Maxilla in the Circumpubertal Period:

1. The Amount of Growth in subjects with Class III Malocclusion is significantly different than in subjects with normal occlusion (unfavorable)

2. In subjects with Class III Malocclusion the Peak in Mandibular Growth lasts longer than in subjects with normal occlusion (5months)

Class III Malocclusion is not helping at all !!!
The CS3-CS4 interval (pubertal growth spurt) is 5 months longer in Class III vs Class I!!

Duration of the Pubertal Peak in Skeletal Class I and Class III subjects
Kuc-Michalska Malgorzata, DDS, PhD, and Tiziano Baccetti, DDS, PhD
Angle Orthod 2010;80:54-57

B.E. female 18y
B.E. female 18y 8m
Co-Gn=115.2mm
Co-Gn=115.7mm

Facial Growth of Skeletal Class III Malocclusion and the Effects, Limitations, and Long-Term Dentofacial Adaptations to Chincap Therapy
Junji Sugawara and Hiroki Motomi
This article outlines the authors’ research findings on the craniofacial growth of untreated skeletal Class III malocclusion, as well as the short-term and long-term effects of dento-orthopedic forces on the craniofacial complex. The study aimed to investigate the craniofacial growth of untreated skeletal Class III subjects compared to Class I subjects. The findings suggested that untreated skeletal Class III malocclusion may have long-term effects on the craniofacial complex, including changes in maxillary and mandibular growth patterns. The authors recommended the use of skeletal orthopedic appliances to correct Class III malocclusions.

FUNDAMENTAL CONCEPT
# 2
Use an efficient Treatment Protocol (predictable results as demonstrated in the literature through evidence-based data)

RME & Facemask

Original Article
Craniofacial growth of Class III subjects six to sixteen years of age
Sara M. Wolfe; Enzo A. Araujo; Rohr G. Behrensmeyer; Peter H. Buschang
Angle Orthod 2011;81:211-6
✓ Maxillomandibular relationships of Class III subjects progressively worsen between 6 and 16 years of age.
✓ Class III subjects have smaller, but not more retrusive, maxilla than Class I subjects; maxillary size differences are established early and maintained through 16 y of age.
✓ Class III subjects have larger, more protrusive mandibles with AP growth excesses that accumulate over time. Class III subjects also have hyperdivergent mandibles and excessive growth of lower facial height.
CLASS III MALOCCLUSION
TREATMENT PROTOCOL

1) Rapid maxillary expansion with a bonded acrylic splint expander with vestibular hooks

2) Orthopedic protraction of the maxilla with facial mask

Should rapid maxillary expansion be performed ALWAYS before orthopedic protraction of the maxilla?

CONTROVERSY!!

- "Activation" of circumaxillary sutures (Stambach et al., 1966)
- More effective protraction (Baik, 1995)
- No difference in maxillary protraction between previously expanded and expanded patients (Vaughn et al., 2005) (short-term RCT)

Bonded RME: Acrylic Splint Expander

Components:
- Hyrax-type screw with four lateral wire extensions
- Wire framework on posterior teeth (.040" SS)
- Acrylic splints (3 mm thick)
- Biocryl™ with a thermal pressure machine (Biostar™)

The wire framework extends around the buccal and lingual surfaces of the posterior teeth. In the vertical plane, the framework is positioned at half the height of the crowns. The hooks for protraction are soldered at the level of the deciduous first molars.

From a posterior view, the screw and the lateral wire extensions should stay at least 2 mm away from the surface of the palate.

AT THIS TIME THE SCREW IS BLOCKED AND THE FACE MASK DELIVERED: ON THE SAME DAY !!!
2) Facial Mask Therapy: Petit’s facial mask

**Sequential Use of Elastics:**
- Bilateral 3/8” (9.5mm) 8 oz (first 2 weeks)
- Bilateral 1/2” (12.7mm) 14-16 oz
- Bilateral 3/8” (9.5mm) 14-16 oz
- Bilateral 5/16” (8.0mm) 14-16 oz

Forward-downward direction of extra-oral elastics

Full-time wear until overjet is overcorrected (4 to 5 mm)
Nighttime wear for an additional 3- to 6-month-period

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**Treatment Protocol**

Long-term effects of Class III treatment with rapid maxillary expansion and facemask therapy followed by fixed appliances

* Patients corrected to overjets of greater favorable outcomes over the long term.

The 8 subjects who could not maintain a positive overjet throughout the pubertal growth spurt, on average, had attained smaller increments of overjet change than the other patients.

*Patients corrected to overjets of greater favorable outcomes over the long term.*

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**Facial Mask Therapy**

Patients corrected to overjets of greater favorable outcomes over the long term.

The 8 subjects who could not maintain a positive overjet throughout the pubertal growth spurt, on average, had attained smaller increments of overjet change than the other patients.
Appliance Removal
The expander is removed easily by simply torquing the appliance laterally and inferiorly on one side and then the other.

WHEN FACEMASK THERAPY IS TERMINATED THE RME IS USED AS A REMOVABLE RETENTION APPLIANCE FOR 1 WEEK

Appliance Removal
IMMEDIATELY AFTER REMOVAL
72 HOURS AFTER REMOVAL

WHEN FACEMASK THERAPY IS TERMINATED THE RME IS USED AS A REMOVABLE RETENTION APPLIANCE FOR 1 WEEK

RETENTION WITH THE REMOVABLE MANDIBULAR RETRACTOR: 1 YEAR, MOSTLY AT NIGHT

REMOVABLE MANDIBULAR RETRACTOR
• Easy to construct
• Easy to wear
• Good 3-D growth control
• Possibility to add auxiliary devices (springs, grid, labial pads)
**Typical Orthopedic Protocol for Class III Malocclusion**

1. **RME:** one week of screw activations, 1 activation/day
   - in case of absence of transverse interarch discrepancy
   - hypercorrection of transverse interarch relationships
   - in case of presence of transverse discrepancy
   - (usually 3 to 5 weeks)
2. **Face mask:** delivered the last day of RME activation
   - from 6 to 8 mos of fulltime wear (16h/day) until overjet 4mm
3. **Face mask:** additional 4 to 6 mos of nighttime wear
4. **Removable mandibular retractor:** 1 year, 14h/day
5. **Fixed appliances:** to refine occlusion (Class III elastics can be added)

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**Treated Group**

(22 Class III subjects)

University of Florence and University of Rome “Tor Vergata”

<table>
<thead>
<tr>
<th>Time</th>
<th>Age (years ± standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>9.2 ± 1.6</td>
</tr>
<tr>
<td>T2</td>
<td>14.5 ± 1.9</td>
</tr>
<tr>
<td>T3</td>
<td>18.7 ± 2.1</td>
</tr>
</tbody>
</table>

- **T1-T2:** RME/FM + fixed appliances
- **T1-T3:** long-term observation interval (9.5 ys)

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**Control Group**

University of Florence

Matched control groups of subjects with **untreated Class III malocclusion** were selected for the 2 observation intervals:

- T1-T2  \( n = 16 \)
- T1-T3  \( n = 13 \)

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**Long-Term Treatment Effects Produced by RME & FM**

Stability of rapid maxillary expansion and facemask therapy: A long-term controlled study

Caterina Meucci, Lorenzo Proraci, Fabio Debara, Manuela Musumeci, Fabio Cozza, and Tatiana Baccetti

*AJO-DO 2011;146:493-500*

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**Original Article**

**NO CONTROLS!**

Long-term Efficacy of Reverse Pull Headgear Therapy

Andrew P. Wells; David M. Serven; William R. Prettit

*Angle Orthod 2006;76:915-22*

- 18 patients at 10 y posttreatment
- **NO CONTROLS!**

Long-term follow-up of early treatment with reverse headgear

Urban Höggi, Agnes Tse, Margareta Berdebus and A. Bak M. Rabie

Orthodontics, Faculty of Dentistry, The University of Hong Kong, Hong Kong SAR, Hong Kong

*Eur J Orthod 2003;25:95-102*

- 21 patients at 8 y posttreatment
Facial Mask

**ORTHOPEDIC FORCES**
Bilateral 16 oz elastics

Forward-downward direction of extra-oral elastics

Patients were instructed to wear FM for a minimum of 14h/die. All patients were treated at least to a positive overjet before discontinuing treatment.

**Treated Group vs. Control Group**

**T1-T2 Interval**
(RME/FM + fixed appliances)

- Significant dentoalveolar effects
- Favorable skeletal changes, mainly in the mandible
- No mandibular backward rotation

**Treated Group vs. Control Group**

**T1-T3 Long-term Interval**

- Significant dentoalveolar effects
- Favorable skeletal changes in the mandible
- No mandibular backward rotation

**SUCCESS RATE:**
73% (16 out of 22 patients)

**6 UNSUCCESSFUL CASES:**
Class III molar relationship and negative overjet at T3

**UNSUCCESSFUL CLASS III CASES**
modest degree of compliance during active therapy with the facial mask

**CRANIOFACIAL FEATURES vs SUCCESSFUL CASES AT T1**

- Facial divergence (FMA +4.1 °)
- Gonial angle (+3.8 °)
- Mesial molar relationship (+1.5 mm)

**FUNDAMENTAL CONCEPT # 3**

*What is the role of treatment timing in the effectiveness of orthopedic therapy of Class III malocclusion?*

Is pre-pubertal treatment more effective than treatment during puberty?

Lorenzo Franchi, DDS, PhD; Tiziano Baccetti, DDS, PhD; and James A. McNamara, Jr., DDS, PhD (Am J Orthod Dentofacial Orthop, 2004;126:555-68)
### Treated Sample

(45 subjects – RME/FM)

- **Early-Treated Group (ETG)**
  - 33 subjects
  - T1 = 7 y 5 m = 1 y 3 m *
  - T2 = 14 y 6 m = 1 y 9 m
  - T2 - T1 = 7 y 2 m = 2 y 1 m

- **Late-Treated Group (LTG)**
  - 12 subjects
  - T1 = 10 y 9 m ± 1 y 4 m **
  - T2 = 15 y 2 m ± 1 y 6 m
  - T2 - T1 = 4 y 5 m ± 1 y 7 m

* Deciduous or early mixed dentition (CS 1)

** Late mixed dentition (75% of the subjects: CS 3)

T2 = after the peak in mandibular growth (CS 5 or 6)

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### Control Sample

(Caucasian subjects with untreated Class III malocclusion)

(24 subjects)

- **Early Control Group (ECG)**
  - 14 subjects
  - T1 = 7 y 0 m ± 1 y 3 m *
  - T2 = 15 y 0 m ± 2 y 3 m
  - T2 - T1 = 8 y 0 m ± 2 y 8 m

- **Late Control Group (LCG)**
  - 10 subjects
  - T1 = 10 y 8 m ± 1 y 10 m **
  - T2 = 16 y 0 m ± 1 y 7 m
  - T2 - T1 = 5 y 4 m ± 1 y 3 m

* Deciduous or early mixed dentition (CS 1)

** Late mixed dentition (70% of the subjects: CS 3)

T2 = after the peak in mandibular growth (CS 5 or 6)

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**Physiologic changes in the maxillary sutures**

Palato-maxillary suture

horizontal section

- 5 years old
- 12 years old

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**Post-Pubertal Assessment of Treatment Timing**

for Maxillary Expansion and Protraction Therapy followed by Fixed Appliances

Lorenzo Franchi, DDS, PhD, Tiziano Baccetti, DDS, PhD and James A. McNamara, Jr., DDS, PhD

(Am J Orthod Dentofacial Orthop, 2004;126:555-68)

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"In those patients who receive a first phase of treatment at a pre-pubertal phase of development and do not achieve a completely satisfactory correction of the malocclusion, a second phase of RME/face mask therapy can be accomplished at the peak in skeletal growth with the more limited aim of restricting mandibular growth".

**RME & Facial Mask:**

"Two-chance" treatment

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**Growth of the Maxilla**

(Melsen, 1972, 1974)

<table>
<thead>
<tr>
<th>CS 1</th>
<th>CS 2</th>
<th>CS 3</th>
<th>CS 4</th>
<th>CS 5</th>
<th>CS 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-pubertal</td>
<td>Pubertal</td>
<td>Post-pubertal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

pterygo-maxillary sutures

active

OSSIFIED

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A.T. 8 ys - 11 ys - 18 ys: Early Treatment

Pre-tx  Post-retention  Long-term

CS 1  CS 2  CS 6

Anterior morphogenetic rotation
(Lavergne and Gasson, 1977)

Chin Cap Force to a Growing Mandible
Long-term clinical reports

Hideo Mitani
Toshihiko Sakamoto

Mandibular skeletal changes induced by early functional treatment of Class III malocclusion: A superimposition study
Isabelle Toffano, MD, DDS; Fabio Bizzetti, DDS; and Lorenzo Franchi, DDS

AJO-DO 1995;108:525-32

Long-term stability of skeletal Class III patients treated with splints, Class III elastics, and chin cup
Adalberto Fiore, MD, MS; Latessa Perillo Nucci, MD, MS, PhD; Fabio Bizzetti, DDS, MS, PhD; and

Gian Carlo, MS

AJO-DO 2003;123:423-34
12

FUNDAMENTAL CONCEPT # 4
When planning treatment of a Class III patient consider how to increase treatment efficacy:

What can be done in severe Class III cases?
Do we have treatment alternatives?
How can we modify the RME & FM protocol to increase the efficacy on maxillary protraction?

NEW PERSPECTIVES ON CLASS III TREATMENT IN THE LAST 10 YEARS

New FRONTIERS of Class III Treatment

DENTOFACIAL ORTHOPAEDICS

ORTHOGNATHIC SURGERY

New FRONTIERS of Class III Treatment

DENTOFACIAL ORTHOPAEDICS

ORTHOGNATHIC SURGERY

Without bony anchorage

With bony anchorage

BAMP protocol

Hugo De Clerck

Surgery-First Orthognathic Approach

José Augusto Mendes Miguel

Early Orthognathic Surgery

Carlos Villegas

Effective maxillary orthopedic protraction for growing Class III patients: a clinical application simulates distraction osteogenesis.

Liou EJ

“ALT-Ramec” MAX EXPANSION/CONSTRUCTION + MAX PROTRACTION

A new protocol for maxillary protraction in cleft patients: repetitive weekly protocol of alternate rapid maxillary expansions and constrictions.

Liou EJ & Tsai WC
Timing of ALT-Ramec Tx
in published data:

Age: 10-13 ys
Late Mixed / Permanent Dentition
Pubertal stages
NOT IDEAL!

Expansión (RME) en dientes deciduos
4 semanas alternadas
(EXP/CONSTRICCIÓN)
0.4 mm/día

Max Protracción
(Máscara Facial)
500 g x lado
16 hrs/día, 6 meses

Liou & Tsai, 2005
10 consecutivamente trataron pacientes
con cleft lip unilateral y paladar
"El resultado de la cantidad total de avance maxilar
en el grupo AltRamec fue de 5.8 ± 2.3 mm en A punto.
Este resultado se mantuvo estable, sin
significativa relapso después de 2 años"
F.F. female 7 ys

<table>
<thead>
<tr>
<th>Measurement</th>
<th>T2-T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>+4.0°</td>
</tr>
<tr>
<td>SNB</td>
<td>0.0°</td>
</tr>
<tr>
<td>ANB</td>
<td>+4.0°</td>
</tr>
<tr>
<td>A to Nasion perp</td>
<td>+5.0 mm</td>
</tr>
<tr>
<td>Pog to Nasion perp</td>
<td>0.0 mm</td>
</tr>
<tr>
<td>Palatal Plane to FH</td>
<td>-1.0°</td>
</tr>
<tr>
<td>Mandibular Plane</td>
<td>0.0°</td>
</tr>
<tr>
<td>P-Palatal-P. Mand</td>
<td>-1.0°</td>
</tr>
</tbody>
</table>

Three-dimensional assessment of maxillary changes associated with bone anchored maxillary protraction

Alt-RAMEC vs. RME & MF

- Favorable effects both on the maxilla and the mandible (NS)
- Significant correction of intermaxillary discrepancy

Alt-RAMEC protocol
- 20 patients (9f e 11m)
- T1: 6.2 ± 0.9 y
- T2: 7.9 ± 1.0 y
- T1-T2: 1.7 ± 0.4 y

RME & MF protocol
- 20 patients (9f e 11m)
- T1: 6.6 ± 1.0 y
- T2: 8.0 ± 1.2 y
- T1-T2: 1.5 ± 0.6 y

Wits = +2.3 mm*  +1.0 ns

Bone-Anchored Maxillary Protraction

Pilot Study
Department of Orthodontics—Università degli Studi di Firenze

Alt-RAMEC protocol
- 20 patients (9f e 11m)
- T1: 6.2 ± 0.9 y
- T2: 7.9 ± 1.0 y
- T1-T2: 1.7 ± 0.4 y

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Alt-RAMEC vs. RME & MF

- Favorable effects both on the maxilla and the mandible (NS)
- Significant correction of intermaxillary discrepancy

New FRONTIERS of Class III Treatment

DENTOFACIAL ORTHOPEDICS
- Without bony anchorage
- Early ALT-Ramec

ORTHOGNATHIC SURGERY
- With bony anchorage
- BAMP

REVOLUTION
Thank You!

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