Lecture outline
6 fundamental concepts to improve the efficacy of Class III orthopedic treatment
1. Genetics and Class III malocclusion
2. Growth in untreated Class III subjects
3. RME & FM treatment protocol – Long-term
4. Treatment timing for RME & FM therapy
5. Mechanisms to control mandibular growth
6. Effects produced by early Alt-RAMEC protocol

Skeletal Class III malocclusion has a significant genetic component

FUNDAMENTAL CONCEPT # 1
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 1p36, 12q23, and 12q13

Giuseppe Genna, anthropologist (1986-1988)
Joanna of Austria married Francesco I de' Medici in 1565 in Florence and became Gran Duchess of Tuscany.

The Vasarian Corridor was built in 1564 by Giorgio Vasari in only five months at the time of the wedding between Francesco I de' Medici and Joanna of Austria.

The Fountain of Neptune by B. Ammannati (1563–1565) was commissioned on the occasion of the wedding of Francesco I de' Medici with Joanna of Austria in 1565.

Eleonora Gonzaga de' Medici, 1567-1611

Maria de' Medici, 1573-1642
CLASS III MALOCCLUSION:
A SERIOUS CHALLENGE IN DENTOFACIAL ORTHOPEDICS

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

FUNDAMENTAL CONCEPT # 2

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 is more intense (males) and the postpeak growth is higher and lasts longer than Class I subjects

Department of Orthodontics
University of Florence
and University of Michigan, USA

Longitudinal observations on
22 Untreated Caucasian subjects
with Class III malocclusion

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

<table>
<thead>
<tr>
<th>Time 2</th>
<th>Age</th>
<th>Postpubertal (CS 5 or CS 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 years and 2 months</td>
<td></td>
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Baccetti T. and Franchi L., CGS Series 2004

Growth in the Untreated Class III Subject

The present study was designed to provide an estimation of growth in intact subjects with Class III malocclusion by means of the analysis of biometric landmarks. Seventy subjects were divided into two groups: 35 Class III malocclusion and 35 normal occlusion. The groups were matched for age and sex. The growth of these groups was monitored from childhood (before and during puberty) to a total age of 17 years. The analysis of biometric landmarks allowed an estimation of the skeletal changes during these periods. The results showed a significant difference in the growth of the Class III malocclusion group compared to the normal occlusion group. The findings suggest that Class III malocclusion is associated with a higher rate of postpeak growth, which lasts longer than in normal occlusion subjects. The results of this study provide valuable insights for the development of treatment strategies for Class III malocclusion.

Midfacial Length
Mandibular Length

Co
A
Gn
Class III vs. Class I
Excessive Growth of the Mandible with reference to the Maxilla in the Circumpubertal Period:

- 2 mm

6 mm

+ 4 mm

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 pubertal peak is more intense (males) and the postpeak growth is higher and lasts longer than Class I subjects

Growth in the Untreated Class III Subject
Fusion Baratta, Duncan Fokes, and James A. McNamara, Jr

Mandibular length and CVM stages

FUNDAMENTAL CONCEPT # 3
Use an effective and efficient treatment protocol (predictable results as demonstrated in the literature through long-term data)

RME & Facial mask

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

Orthopedic Treatment of Class III Malocclusion

RME

Facial Mask
How much activation of the expansion screw?

Until the lingual cusps of the upper posterior teeth approximate the buccal cusps of the lower posterior teeth

AT THIS TIME THE SCREW IS BLOCKED AND THE FACE MASK DELIVERED ON THE SAME DAY

Treatment Protocol

2) 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 (16h/day) until overjet is overcorrected (4 to 5 mm)
Nighttime wear for an additional 3- to 6-month-period

Appliance Removal

The expander is removed easily by simply torquing the appliance laterally and inferiorly on one side and then the other

RETENTION WITH THE REMOVABLE MANDIBULAR RETRACTOR:
1-2 YEARS 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)

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

Patients corrected to overjets of 4.5 mm or greater during RME/FM therapy, however, all sustained 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.

“AJO-DO 2003;123:306-20

Ngan et al 1997

AJO-DO 2003;123:306-20

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Typical Orthopedic Protocol for Class III Malocclusion

1. RME: overcorrection of transverse interarch relationships in case of presence of transverse discrepancy (usually 3 to 5 weeks)
2. Facial mask: 6 mos of fulltime wear (16h/day) until ovj > 4mm
3. Facial mask: additional 3 to 6 mos of nighttime wear
4. Removable mandibular retractor: 1-2 years, 10-14h/day
5. Fixed appliances: to refine occlusion (Class III elastics) in the postpubertal period

LONG-TERM TREATMENT EFFECTS PRODUCED BY RME & FM

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

Treated Group
(22 Class III subjects)
University of Florence and University of Rome “Tor Vergata”

<table>
<thead>
<tr>
<th>T1</th>
<th>9.2 ys ± 1.6 ys</th>
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<tbody>
<tr>
<td>(all subjects CS 1-3)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>14.5 ys ± 1.9 ys</td>
</tr>
<tr>
<td>T3</td>
<td>18.7 ys ± 2.1 ys</td>
</tr>
<tr>
<td>(at least 2 years after CS 6)</td>
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T1-T2: RME/FM + fixed appliances
T1-T3: long-term observation interval (9.5 ys)

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

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
**FUNDAMENTAL CONCEPT # 4**

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

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

**FUNDAMENTAL CONCEPT # 4**

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

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

**UNSUCCESSFUL CLASS III CASES**

modest degree of compliance during active therapy with the facial mask

CRANIOFACIAL FEATURES vs SUCCESSFUL CASES AT T1

↑ Facial divergency (FMA +4.1 deg.)

↑ Gonial angle (+3.8 deg.)

↑ Mesial molar relationship (+1.5 mm)

Post-Pubertal Assessment of Treatment Timing for Maxillary Expansion and Protraction Therapy followed by Fixed Appliances

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

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

**RME & Facial Mask: Early vs. Late**

PERIODIC VARIATIONS IN GROWTH RATE

Growth of the Maxilla

(Melsen, 1972, 1974)

Physiologic changes in the maxillary sutures

Palato-maxillary suture horizontal section

Museum of Anthropology, The University of Florence

Growth of the Maxilla

(eleven)
FUNDAMENTAL CONCEPT # 5

What is the mechanism for mandibular growth control following early treatment of Class III malocclusion?

S.R. 6 y 6 m - 14 y 6 m – 19 y 6 m Early Treatment

Pretreatment After comprehensive treatment Long-term observation

6 y 6 m 19 y 6 m

Anterior morphogenetic rotation (Lavergne and Gasson, 1977)

6y6m 19y6m

TPS Analysis of Long-Term Mandibular Changes

Treated Group

Control Group

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

Hideo Mitani
Toshihiko Sakamoto

Angle Orthod 1984;54:93–122
FUNDAMENTAL CONCEPT #6

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?

Expansion (RME) on deciduous teeth

<table>
<thead>
<tr>
<th>Alternate Weekly Sequence</th>
<th>Weekly Amount of exp/cons</th>
<th>Daily Amount of activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion</td>
<td>2.8 mm</td>
<td>0.4 mm</td>
</tr>
<tr>
<td>Constriction</td>
<td>2.8 mm</td>
<td>0.4 mm</td>
</tr>
<tr>
<td>Expansion</td>
<td>2.8 mm</td>
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<td>Expansion</td>
<td>2.8 mm</td>
<td>0.4 mm</td>
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Max Protraction (Facial Mask)
500 g x side
14 hs/day, 6 months + Night only, 6 months

Early Alt-RAMEC and Facial Mask Protocol in Class III Malocclusion

Treated Groups

<table>
<thead>
<tr>
<th>Alt-RAMEC protocol</th>
<th>RME &amp; FM protocol</th>
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<tbody>
<tr>
<td>31 patients (14f e 17m)</td>
<td>31 patients (14f e 17m)</td>
</tr>
<tr>
<td>T1: 6.4 ± 0.8 y</td>
<td>T1: 6.9 ± 1.1 y</td>
</tr>
<tr>
<td>T2: 8.1 ± 0.9 y</td>
<td>T2: 8.5 ± 1.3 y</td>
</tr>
<tr>
<td>T1-T2: 1.7 ± 0.4 y</td>
<td>T1-T2: 1.6 ± 0.6 y</td>
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**Clinical Study**  
Department of Orthodontics–Università degli Studi di Firenze

**Control Group**  
(Untreated Class III Malocclusion)  
21 subjects (10f e 11m)  
T1: 6.5 ± 1.0 y  
T2: 8.0 ± 1.1 y  
T1-T2: 1.5 ± 0.4 y

**Alt-RAMEC vs. Ctrls**
- Significant favorable effects both on the maxilla and the mandible
- Significant correction of intermaxillary discrepancy
- Significant closure of the mandibular angle (CoGoMe)
  
\[ \text{Alt-RAMEC} \]

\[ \text{ANB} = +4.9^* \]
\[ \text{ANB} = +1.9^* \]

**RME & FM vs. Ctrls**
- Significant favorable effects both on the maxilla and the mandible
- Significant correction of intermaxillary discrepancy
- Significant closure of the mandibular angle (CoGoMe)

\[ \text{RME & FM} \]

\[ \text{ANB} = +3.2^* \]
\[ \text{ANB} = +1.3^* \]

**Alt-RAMEC vs. RME & FM**
- Significantly greater protraction of the maxilla
- Significantly greater correction of intermaxillary discrepancy

\[ \text{Alt-RAMEC} \]

\[ \text{ANB} = +3.1^* \]
\[ \text{ANB} = +0.4ns \]

Can we Improve the Efficacy of Early Class III Treatment?

- Consider skeletal maturity in tx planning
- Treatment before puberty can increase the efficacy of maxillary protraction
- Use an effective treatment protocol (RME+FM)
- Overcorrect
- New orthopedic approaches seem to be promising but we have to wait for long-term data
Thank you!!

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