Point/Counterpoint: The Case for Non-extraction in the Mixed Dentition

2015 AAO Winter Conference

Miami, Florida  February 6, 2015
Over 100 Years

Expansion

Extraction
What types of problems are encountered in the early mixed dentition?
Some Problems Observed in the Early Mixed Dentition

- Crossbites
- Tooth-size/arch size discrepancies
Some Problems Observed in the Early Mixed Dentition

- Crossbites
- Tooth-size/Arch size discrepancies
Some Problems Observed in the Early Mixed Dentition

Dentoalveolar Protrusion
Paradigm Shift #1:
RME in the *absence* of crossbite
Maxillary adaptations following expansion in the mixed dentition

*Spillane LM, McNamara JA Jr
Sem Orthod 1:176-187, 1995*

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Unilateral crossbite</td>
<td>37</td>
<td>22%</td>
</tr>
<tr>
<td>Bilateral crossbite</td>
<td>6</td>
<td>4%</td>
</tr>
<tr>
<td>No crossbite</td>
<td>119</td>
<td>74%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>162</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Maxillary adaptations following expansion in the mixed dentition

74% of our patients had no crossbite at the beginning of treatment

<table>
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<th>Count</th>
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</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>100%</td>
</tr>
</tbody>
</table>
Recommendation #1:

Measure Transpalatal Width Directly at the Initial Examination

How do you do it?
Clinical Measuring Techniques
Measuring Transpalatal Width
Measuring Transpalatal Width
Clinical Measuring Techniques

Transpalatal Width - Adult: 35-39 mm

Transpalatal Width - Child: 33-35 mm

TP Width <31 mm

M-D Width of U1

Transpalatal Width
Recommendation #2:

Measure the Mesiodistal Diameter of an Upper Central Incisor

The world’s easiest mixed dentition analysis

How do you do it?
11 mm Width of U1
Clinical Measuring Techniques

Male: $8.9 \pm 0.6$ mm
Female: $8.7 \pm 0.6$ mm

M-D Width $>10.0$ mm

M-D Width of U1
Paradigm Shift #2:
Spontaneous Improvement of Class II Malocclusion following RME
The case for extraction or non-extraction in the early mixed dentition?

It is not an either/or decision

Lots of choices are available
Management of Tooth-size Arch-size Discrepancies: Choices

- Interproximal Reduction
- Extraction
- Space Maintenance
- Expansion

Combinations of above also can be used
Management of Tooth-size Arch-size Discrepancies

Interproximal Reduction
Management of Tooth-size Arch-size Discrepancies

- Used liberally in the permanent dentition (~50% of cases)
- Used rarely in the mixed dentition
Management of Tooth-size Arch-size Discrepancies

Extraction

Current US Extraction
Average ~25%

Our Practice Extraction
Average 12%

We extract in ~10% of early tx patients
Serial Extraction
GUIDELINES FOR SERIAL EXTRACTION

1. Used in instances of gross crowding (7-10 mm)
2. Used in patients with well-balanced faces
3. Indicated in patients with large tooth-size

>10.0 mm Width of U1
Limited Use: Frequency 1-2%
Transpalatal arch

~2.0 mm per side

Moyers et al., 1976

Lingual arch

~2.5 mm per side

Moyers et al., 1976

LLA also can be used for modest expansion

Space Maintenance
Management of Tooth-size Arch-size Discrepancies

- Expansion
  - Orthodontic Expansion
  - Orthopedic Expansion
The cornerstone of successful expansion of the dental arches that demonstrates satisfactory long-term stability is rapid maxillary expansion.
Generic Question

Is rapid maxillary expansion stable?

Angell, 1860

Haas, 1959, 1961
Long-term Evaluation of Rapid Maxillary Expansion Followed by Fixed Appliance Therapy

McNamara JA Jr, Baccetti T, Franchi L, Herberger TA

Angle Orthodontist

2003;73:344-353
<table>
<thead>
<tr>
<th></th>
<th>Tx</th>
<th>No Tx*</th>
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</thead>
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<tr>
<td>Males</td>
<td>51</td>
<td>24</td>
</tr>
<tr>
<td>Females</td>
<td>61</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>41</td>
</tr>
</tbody>
</table>

* University of Michigan and University of Groningen Growth Studies
1. Haas expander activated for three weeks
2. Expansion 10.0 - 10.5 mm
3. Three months post-activation period
4. RME followed by fixed appliances
# Age at Observation

<table>
<thead>
<tr>
<th></th>
<th>RME</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_1$</td>
<td>12 yr 2 mo</td>
<td>11 yr 6 mo</td>
</tr>
<tr>
<td>$T_2$</td>
<td>14 yr 6 mo</td>
<td>13 yr 11 mo</td>
</tr>
<tr>
<td>$T_3$</td>
<td>20 yr 5 mo</td>
<td>19 yr 7 mo</td>
</tr>
<tr>
<td>$T_3-T_1$</td>
<td>8 yr 3 mo</td>
<td>8 yr 1 mo</td>
</tr>
<tr>
<td>Stage</td>
<td>$T_1-T_2$</td>
<td>$T_2-T_3$</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Treatment</td>
<td>6.5</td>
<td>-3.5</td>
</tr>
<tr>
<td>Controls</td>
<td>-1.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>Difference</td>
<td>7.5</td>
<td>-1.5</td>
</tr>
</tbody>
</table>
### Mandibular Arch Perimeter (mm)

<table>
<thead>
<tr>
<th>Stage</th>
<th>$T_1 - T_2$</th>
<th>$T_2 - T_3$</th>
<th>$T_1 - T_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>4.0</td>
<td>-2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Controls</td>
<td>-1.0</td>
<td>-2.0</td>
<td>-3.0</td>
</tr>
<tr>
<td>Difference</td>
<td>5.0</td>
<td>-0.5</td>
<td>4.5</td>
</tr>
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</table>
### Lower Intercanine Width (Centroid)

<table>
<thead>
<tr>
<th>Stage</th>
<th>$T_1 - T_2$</th>
<th>$T_2 - T_3$</th>
<th>$T_1 - T_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1.9</td>
<td>-0.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Controls</td>
<td>-0.3</td>
<td>-0.5</td>
<td>-0.8</td>
</tr>
<tr>
<td>Difference</td>
<td>2.2</td>
<td>-0.1</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Bonded RME
Children: Mixed Dentition *(RME only)*

- Bonded rapid maxillary expander
- Bond U2-2 (60-70%)
- Maintenance plate, TPA later
- Comprehensive edgewise orthodontics
## Phases of Treatment

**RME, DB 2-2**

<table>
<thead>
<tr>
<th>Age (Yrs.)</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>K</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

**Phase I**

- 9 Months

**Interim Period**
Phases of Treatment

*RME, DB 2-2*

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<tr>
<th>Age (Yrs.)</th>
<th>6</th>
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<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

- **Phase I**: 9 Months
- **Interim Period**: 18 Months
Long-Term Stability of Rapid Maxillary Expansion in the Mixed Dentition

Geran RE, McNamara JA Jr, Baccetti T, Franchi L, Shapiro LM
Am J Orthod Dentofacial Orthop
2006;129:631-640
Treatment Protocol

1. Initial sample of 256 consecutively-treated early mixed dentition patients from the *Michigan Expansion Study*

2. Treated with:
   - Acrylic splint RME
   - Brackets on upper incisors, if needed
   - Maintenance plate, transpalatal arch
   - Comprehensive fixed appliances

*Geran et al, 2006*
<table>
<thead>
<tr>
<th>Interval</th>
<th>RME</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>8 yr 10 mo</td>
<td>8 yr 9 mo</td>
</tr>
<tr>
<td>Post-treatment</td>
<td>13 yr 10 mo</td>
<td>14 yr 2 mo</td>
</tr>
<tr>
<td>Long-term</td>
<td>19 yr 9 mo</td>
<td>19 yr 9 mo</td>
</tr>
</tbody>
</table>
### Maxillary Arch Perimeter (mm)

<table>
<thead>
<tr>
<th>Group</th>
<th>$T_1$-$T_3$</th>
<th>$T_3$-$T_4$</th>
<th>$T_1$-$T_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-1.8</td>
<td>-2.0</td>
<td>-3.8</td>
</tr>
<tr>
<td>RME</td>
<td>0.9</td>
<td>-0.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Difference</td>
<td>2.7</td>
<td>1.1</td>
<td><strong>3.8</strong></td>
</tr>
</tbody>
</table>

*Geran et al, 2006*
<table>
<thead>
<tr>
<th>Group</th>
<th>$T_1-T_3$</th>
<th>$T_3-T_4$</th>
<th>$T_1-T_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-4.4</td>
<td>-1.8</td>
<td>-6.2</td>
</tr>
<tr>
<td>RME</td>
<td>-2.4</td>
<td>-1.3</td>
<td>-3.6</td>
</tr>
<tr>
<td>Difference</td>
<td>2.0</td>
<td>0.5</td>
<td>2.6</td>
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</tbody>
</table>

Note: No active lower expansion (e.g., Schwarz appliance) was used.

Geran et al, 2006
Long-term Stability
(From end of treatment to six years post-treatment)

Intermolar width: 94%

Net loss in mandibular arch perimeter:
- Control Group: -1.8 mm
- RME group: -1.3 mm

Geran et al, 2006
Children: Mixed Dentition (*Schwarz* – *RME*)

- Schwarz appliance (40%)
- Rapid maxillary expansion
- Bond U2-2 (60-70%)
- Maintenance plate, TPA later
- Comprehensive edgewise orthodontics
TYPICAL PHASE I PROTOCOL

- Schwarz appliance
- Bonded RME
- Brackets on Incisors (?)
MANDIBULAR DENTOALVEOLAR DECOMPENSATION:

Often initiated prior to rapid maxillary expansion
MANDIBULAR DENTOALVEOLAR DECOMPENSATION:

Often initiated prior to rapid maxillary expansion
## Phases of Treatment

*Schwarz, RME, DB 2-2*

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<th>Age (Yrs.)</th>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
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Phase I

![Image of dental phase](image.png)
### Phases of Treatment

**RME, DB 2-2**

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<td>7</td>
<td>8</td>
<td>9</td>
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</tbody>
</table>

**Phase I**: 14 Months

**Phase II**: 18 Months

**Interim Period**: 18 Months
Teeth tipped lingually at start.
Long-Term Stability of Rapid Maxillary Expansion Concurrent with Schwarz Appliance Therapy in the Mixed Dentition

O’Grady PW, McNamara JA Jr, Franchi L, Baccetti T
Am J Orthod Dentofacial Orthop
2006;130:202-213
## Age of Sample

<table>
<thead>
<tr>
<th></th>
<th>Sz-RME</th>
<th>RME only</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_1$</td>
<td>9y 1m</td>
<td>8y 5m</td>
<td>8y 0m</td>
</tr>
<tr>
<td>$T_3$</td>
<td>12y 5m</td>
<td>11y 7m</td>
<td>12y 3m</td>
</tr>
<tr>
<td>$T_4$</td>
<td>14y 4m</td>
<td>13y 3m</td>
<td>13y 4m</td>
</tr>
<tr>
<td>$T_5$</td>
<td>21y 0m</td>
<td>19y 3m</td>
<td>19y 0m</td>
</tr>
</tbody>
</table>

O’Grady et al, 2006
### Initial Transpalatal Width (mm)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>16</td>
<td>32.6</td>
</tr>
<tr>
<td>RME</td>
<td>27</td>
<td>32.5</td>
</tr>
<tr>
<td>Sz-RME</td>
<td>23</td>
<td>32.8</td>
</tr>
</tbody>
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O’Grady et al, 2006
### Maxillary Arch Perimeter (mm)

<table>
<thead>
<tr>
<th>Group</th>
<th>$T_1$-$T_3$</th>
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<th>$T_4$-$T_5$</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sz-RME</td>
<td>2.9</td>
<td>-0.5</td>
<td>-1.1</td>
<td>1.3</td>
</tr>
<tr>
<td>RME</td>
<td>2.6</td>
<td>-1.4</td>
<td>-1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Control</td>
<td>0.2</td>
<td>-1.5</td>
<td>-1.2</td>
<td>-2.5</td>
</tr>
</tbody>
</table>

C – Sz/RME = 3.8 mm

O’Grady et al, 2006
## Mandibular Arch Perimeter (mm)

<table>
<thead>
<tr>
<th>Group</th>
<th>$T_1-T_3$</th>
<th>$T_3-T_4$</th>
<th>$T_4-T_5$</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sz-RME</td>
<td>0.0</td>
<td>-0.3</td>
<td>-1.7</td>
<td>-2.0</td>
</tr>
<tr>
<td>RME</td>
<td>-1.2</td>
<td>-1.2</td>
<td>-1.3</td>
<td>-3.6</td>
</tr>
<tr>
<td>Control</td>
<td>-2.8</td>
<td>-1.6</td>
<td>-1.3</td>
<td>-5.7</td>
</tr>
</tbody>
</table>

C – Sz/RME = 3.7 mm

O’Grady et al, 2006
### Mandibular Canine Width (mm)

<table>
<thead>
<tr>
<th>Group</th>
<th>$T_1-T_3$</th>
<th>$T_3-T_4$</th>
<th>$T_4-T_5$</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sz-RME</td>
<td>2.3</td>
<td>0.5</td>
<td>-1.1</td>
<td>1.8</td>
</tr>
<tr>
<td>RME</td>
<td>1.0</td>
<td>0.4</td>
<td>-0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Control</td>
<td>0.9</td>
<td>-0.1</td>
<td>-0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

C – Sz/RME = 1.4 mm

O’Grady et al, 2006
And Finally……..

Spontaneous Improvement of Class II following Maxillary Expansion
Treatment Plan
NW  8-3

1. Schwarz appliance
2. Bonded acrylic splint expander
3. Maintenance plate
4. TPA at the end of the mixed dentition
5. Comprehensive Phase II treatment

Note: No specific Class II mechanics were used
TP Width = 37 mm

NW 13-8
Mechanism of Correction
Mechanism of Correction
The Analogy of the Foot and the Shoe

Shoe = Maxilla

Foot = Mandible
The Analogy of the Foot and the Shoe

Shoe = Maxilla
Foot = Mandible

McNamara and Brudon, 1993, 2001
Treatment Effects of RME:

What evidence exists to support the concept of “Spontaneous Improvement”?
Article #1:

Improvement in Molar Relationship in Mixed Dentition Patients Treated with Rapid Maxillary Expansion: A Prospective Study

McNamara JA, Sigler LM, Baccetti T, Franchi L, Guest SS

Angle Orthod
2010;80:230-238
Michigan Expansion Study
(1981-present)

A Prospective Clinical Trial in a Private Practice Setting

Original Sample:  \( N = 1,135 \)

Age at Phase I  8 years  7 months

Age at Phase II  12 years  5 months
### Samples

<table>
<thead>
<tr>
<th></th>
<th>Treated:</th>
<th></th>
<th>Untreated:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>224</td>
<td>Male</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>276</td>
<td>Female</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td><strong>500</strong></td>
<td>Total</td>
<td><strong>188</strong></td>
</tr>
</tbody>
</table>

*McNamara et al., 2010*
<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T1 – T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>8.8 ±1.1 yr</td>
<td>13.2 ±1.1 yr</td>
<td>3.7 years</td>
</tr>
<tr>
<td>Untreated</td>
<td>9.3 ±0.9 yr</td>
<td>12.5 ±1.2 yr</td>
<td>3.9 years</td>
</tr>
</tbody>
</table>

McNamara et al., 2010
Improvement of Molar Relationship in Mixed Dentition Patients Treated with Rapid Maxillary Expansion: A Prospective Study

Class II

End-to-End

Class I
Time 1

Posterior

Anterior

T1 = -2.0 mm

T2 = +1.5 mm

Diff = +3.5 mm

Time 2
Article #2: Recommended

Spontaneous Improvement of Class II Malocclusion in Expansion Patients: A Prospective Clinical Study

Guest SS, McNamara JA Jr, Franchi L, Baccetti T

AJO-DO 2010;138:582-591
Total Molar Change ($T_2-T_1$)

- $0 \text{ mm} = \text{No Change}$
- $-2 \text{ mm} = \text{Worsen}$
- $+2 \text{ mm} = \text{Improve}$

Number of Patients

Increments of Molar Change (in mm)

$Guest \ et \ al, \ 2010$
Guest et al, 2010

Total Molar Change (T₂-T₁)

0.1 ± 0.8

62%

Number of Patients

Increments of Molar Change (in mm)

Control

Guest et al, 2010
Total Molar Change ($T_2-T_1$)

- Control:
  - 0%: 0
  - 18%: 1
  - 62%: 1
  - 20%: 1
  - 92%: 1

- Treated:
  - 0%: 0
  - 48%: 1

Guest et al, 2010
“Rule of Thumb”

During the treatment of Class II malocclusion, the maxillary dental arch should be maintained in a *widened orientation* relative to the mandibular dental arch to assist in the Class II correction.
Take-Home Messages

- There are many ways to treat patients in the early mixed dentition
- Space maintenance is critical
- Serial extraction: >10.0 mm U1
- Spontaneous improvement of Class II (and Class III) malocclusion ~50%
SUMMARY:
CLASSIFICATION OF CROWDING

- Clear-cut Extraction: > 6 mm
- Borderline: 3 - 6 mm
- Obvious Non-Extraction: < 3 mm
What are the long-term changes in arch perimeter with RME?

**Mixed Dentition:**
- **Maxilla:** 3.5 – 4.0 mm
- **Mandible:** 2.5 – 4.0 mm

**Permanent Dentition:**
- **Maxilla:** 5.0 – 6.0 mm
- **Mandible:** 4.0 – 4.5 mm

*Geran et al., 2006; O’Grady et al., 2006*

*McNamara et al., 2003*
A Final Comment Regarding The Treatment Of Tooth-size / Arch-size Discrepancies

COMMON SENSE MUST PREVAIL!
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Not every patient can be expanded successfully in the mixed dentition
Thank You