Treatment of Severe Maxillary and Mandibular Constriction
SARPE & MSDO

AAO 118th Annual Session

Biography
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D.M.D. (Docteur en Médecine Dentaire), University Laval, 1983
Private practice, general dentistry 1983-1988
Certificate in Orthodontics, University of Montreal, 1990
M.Sc. in Dental Sciences, University Laval, 2008
Private practice in orthodontics since 1990
Publications
- Closer look at SARPE, JOMS 2008
- Short-term and long-term stability of SARPE revisited, AJODO 2011
- Long-term dental and skeletal changes following SARPE, letter to editor, OOOO 2013
- Functional genioplasty in growing patients, AO 2015,
- Response to : Functional geniolasty in growing patients by Chamberland et al, AO 2015, 85, 6: p1083
Lecturer in several graduate program and scientific meeting in USA, Canada, Europe

Conflict of Interest Declaration

I declare that neither I nor any member of my family have a financial arrangement or affiliation with any corporate organization offering financial support or grant monies for this continuing education presentation, nor do I have a financial interest in any commercial product(s) or services I will discuss in this presentation

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In order to expand further, we need you to help us by volunteering to serve as a provider orthodontist or help identify orthodontists willing to lead efforts to establish a DOS chapter in your state.

Stop by the DOS booth here in San Diego to learn more about the program or contact Ann Sebaugh at asebaugh@aaortho.org with questions.
Treatment of Severe Maxillary and Mandibular Constriction

- Review of the technique of SARPE and MSDO
- Case reports of combined treatment
- New approach to maxillary expansion
- Conclusion

Mandibular Constriction

- Not so constricted
- Constricted
- Very constricted

Changes in the Dental and Skeletal Dimensions Over Time after SARPE

- Skeletal Expansion
  - Mx & Nasal cavity \( p < 0.0001 \)
  - STABLE: NS \( (p=0.1166) \)
- Dental Expansion \( (7.6 \pm 1.6\text{mm}) \)
  - Sig.Relapses: 24\% \((1.8 \pm 1.8\text{mm})\) at 15 months post SARPE
  - Follow up 24m: Relapse 1.1 mm
    \( \rightarrow 38\% \) of total expansion
- 46\% Sk/Dt at 6 m
- 65\% Sk/Dt at 23.6 m

Covariables

- Low correlation between skeletal and dental changes: \( r = .36; r^2 = 0.13 \)
- Low correlation between screw changes and skeletal change: \( r = 0.41; r^2 = 0.17 \)
- Hemimaxillae do not expand in parallel
- Lateral rotation & alveolar bending

It explains why skeletal expansion is 47\% of maximal dental expansion (T3)
No parallel expansion of hemimaxillae in coronal view

Rotation of hemimaxillae

✦ Inward movement of alveolar border under the osteotomy cut (C, A)
✦ Palatal depth decrease (B)

No escape when hemimaxillae are expanded if the cut is not widened at the zygoma

Obvious inward displacement upon appliance activation per op.
This has been proven by Chamberland & Proffit AJODO 2011

As bone contact, resistance may be similar to non-cut bone

How Much Wide?

3-4 mm wide

MSDO. Early reports

Tooth anchor expansion device
✦ Force is applied above C/R of Md

Activation 1 mm /days

Concerns:
✦ Disproportional widening of the dento-osseous segments (alveolar bone was expanded more than basal bone)
✦ Lower incisor proclination
Tooth-borne Versus Hybrid Devices for MSDO

Greater skeletal expansion was achieved with a hybrid distractor.

Greater dental expansion was achieved with a tooth-borne distractor.

During distraction, the hybrid distractor effected more parallel expansion of basal and alveolar bone than did the tooth-borne distractor.

Long-Term Skeletal & Dental Stability

Follow-up 6-7 years post distraction

✦ T5-T4 Skeletal change: Stable
✦ T5-T4 Dental change:
  ✓ NS slight increase 1st molar

Lessons from the Past

Constricted maxilla
Significant ALD
Crossbite #22, #15
Slight CO/CR discrepancy
Gingival recession
Bimax dentoalveolar protrusion
Retrognathic profile
No anterior guidance in protrusion
- Interferences on balancing side
- Bilateral TMJ clicking on opening
- Pain on palpation of both lateral pterygoid

Tx Option

Non-surgical, extraction of 4 premolars (5’s)
SARPE + MSDO

Tx Plan

SARPE and MSDO

Follow Up

7 days post surgery
✓

Mx: 0.33 mm/day
Md: 0.5 mm/day

3 days into expansion
✓

✓ 21 days post surgery
✓ Sequestra between 31-41
✓ Granulation tissue B #11
End of Distraction

Expansion is slightly larger at the dental level than the mandibular border

At 4 months

Mx: .016 CNT
Md: segment .016 CNT

At 5 months
✦ Removal of both expander, bond molars
✦ Lower arch aligned in 3 segments

At 10 Months

Mx & Md: .016 X .022 cnt
★ Elastomeric chain 42 to 32
★ 2nd molars were not engaged

Parodontal Assessment

Root surfacing was required

March 02

April 2002
Outcome

Class I occlusion was achieved
Slight anterior guidance
Slight curve of Spee maintained
Gingival recession B 31-41

Dental Changes

At 1st molars
✦ Mx: + 4.06
✦ Md: + 6.58

Tx time: 22 months

No TMJ symptoms
Maximum interincisor opening 46 mm

Superposition

Md forward??
/1-MP = maintained
1/-FH increased
Parodontal status maintained or improved
Root parallelism improved, except 21 & 22

Follow up at 31 months

Epilogue

I said that I will never do that again…
But…
✦ Bone anchor device:
✓ Conley RS., Legan HL AJODO 2006; 129:283-92

Missed Opportunity
**Bologna Midline Distractor** (KLS Martin)

1 activation 90° = 0.25 mm
Screw parallel to occlusal plane
Relief 2 mm buccal
Upper connector 2-3 mm apical to gingival margin

Fissure bur
Osteotomy cut deviated to the right where there is more room between roots of 42-43.

Stepped parasagittal cut to widest interradicular site
Distractor seated on abutment teeth to figure out plates adjustment
Inferior plates of the distractor are bent and adjusted to the form of the mandible
Precise plates positioning to ensure stress-free fixation
Osteotomy site

Precise plates positioning to ensure stress-free fixation

Precise adaptation & fixation

Mobility check of bone fragment

Precise adaptation & fixation

Mobility check of bone fragment

2 mm expansion perop

Mucosa margin sutured

Distraction Protocol

Latency period of 7-8 days

✦ Critical to allow time for a callus of good quality to form

Rate of distraction: 1 mm per day

✦ Too fast: can lead to poor bone quality, partial union, fibrous union

✦ Too slow: premature consolidation, inability to obtain the planned amount of expansion

Rhythm of distraction: 0.25 mm qid or 0.50 mm bid

Conley R., Legan H., Mandibular Symphyseal Distraction Osteogenesis: Diagnosis and Treatment Planning Considerations, Angle Orthod 2003;73:3-11
Distraction protocol

Postdistraction orthodontic movement
✦ Should not begin until radiographic evidence of consolidation is observed
✦ Typically 2-3 months

Removal of the distractor
✦ 6 months after the end of distraction

Complications

Irritation to labial mucosa
Gingival inflammation
✦ Careful cleaning is mandatory
Loss of interdental septum
✦ Mesial to 31

Cellulitis
✦ 1 patient required antibiotic therapy + marsupialisation

Hardware problems:
✦ If the surgeon break the thread of the screw or forget to ligate, your are screwed…
Case 2

Class I
Constricted dental arches
Moderate ALD

Orthognathic profile
But slight retrusion of Mx & Md
Mouth breather

End of distraction
Mx: 0.25 mm bid
- mx diastema: 8.6 mm
Md: 0.5 mm bid (2 activations bid or 2 activations morning 1 activation evening)
- 0.75 to 1 mm per day
- Δ intercanine= 5.4 mm, diastema ~ 6 mm

1 m Postdistraction
Latency period was 7 days. Expansion monitored every week
Activation period: 14 days
Note the parallelism of md segment
Bonding at 1 month post distraction
✦ Mx: .016 Supercable™ 15 to 25
✦ Md: .016 Supercable™ 42 to 33
Careful cleaning and root surfacing at each visit

At 20 weeks
✦ Mx: .016 x .022 CNT
✦ Md: .016 CNT

Mx expansion device is removed
✦ Mx and Md arch are coordinated: .020 x .020CNT / .016 X .022CNT
✦ Class I relationship is maintained
✦ Crowding is resolved

Transverse dimension improved
1st, 2nd & 3rd order movement needed for lower and upper anteriors
At 76 weeks
Finishing stages

Final outcome
Tx time 85 weeks
Class I fonctionnal occlusion

Improvement of interincisal relationship
✦ 1/ retroclined 10°, /1 maintained 93°
Profil maintained or improved

Osteogenesis of distraction site
Root surfacing was done mesial of #43 during tx.
Root parallelism obtained (except 34)
**Dental Changes**

- +7.52
- +8.67
- +8.72
- +10.02
- +2.24

Follow up at 2 years

Risk and Complication

- Case from a netsurfer who lives in France
- Oronasal communication
- Open communication mesial to #31

This case is... **POORLY manage**
Risk and Complication

Follow up ~ 1 year
Lack of bone between central incisors
Hyperplasia right concha

Risk and Complication

Follow up
✦ 16 months post MSDO + SARPE
Bone graft has failed
Redo is planned…

Mx & Md Constriction

End of SARPE
Midline osteotomy cut is where there is space available
End of MSDO

Courtesy of Dr Dany Morais & Dr Claude Ganey
Outcome

Final occlusion

Class I
Severe bimax constriction

End of Distraction

Inward rotation of hemimaxilla
Parallel md expansion
✦ Expansion device || occlusal plane
Class I
Missing 42, 41
Maxillary and mandibular constriction
ENT specialist referred for snoring and apnea

Mx et Md Retrusion
Class I skeletal relationship
Proclined 1/ (121°)
Retroclined /1 (79°)

Conley RS., Legan HL., Correction of severe obstructive sleep apnea with bimaxillary transverse distraction osteogenesis and maxillomandibular advancement. AJODO 2006;129:283-92

Similar case published by Conley et Legan
Osteotomy on the midline turning to the right between diverging roots of 43 - 31.

Problems
✦ Complete separation should not be done before fixation of the distractor
✦ Distraction device should be more parallel to the occlusal plane
✦ Fitting of the plates could be improved

Distraction starts 7 days post op
Mx: activation ¼ mm bid
Md:  2 activations morning (0,5 mm) et 1 activation evening (0,25 mm)

End of Distraction at 30 days post op

Distractor canted to the left
Patient noted that the screw seems to unscrew

Nov. 24: reactivation completed + ligature

Dec. 17: Bond Mx teeth

Note

✦ Chances are that thread of the screw were stripped when the surgeon adapted the plates of the device on the symphysis and it may explain the loss of expansion at 1 month post distraction, because there was some slack of the screw when activating.

✦ Or it is because the screw was not ligate and immobilized at the end of distraction.

✦ Advice: Always lock the screw with a ligature with such device.

I accepted the loss of 1 to 2 mm expansion

Because I had to reactivate 1 month after we had stopped distraction I was nervous to reactivate.

What Happen You Don’t Ligate the Screw?

You will likely learn the hard way that you should have ligate…

Complete relapse in 2 months

Call
19 weeks
Osteogenesis at distraction site
Bonding md teeth

At 5½ months
Wide BL width of the distraction site

At 7 Months
Removal Mx distractor Superscrew™

At 8 Months
Removal of the Bologna Distractor
Possible sequela of reactivation at 1 months
Bone Grafting

Follow up 2 months post grafting

Baseline June 2014 on left
Progress January 2016 →

69 weeks

Mx width 59.6
+5.9 mm
Mx width 65.5
82 weeks

Implant placement with a surgical guide

94 weeks

Follow up 61 weeks into retention
Follow up 61 weeks into retention

- Good osteogenesis
- Increase oropharynx airway

Airways

- Oropharynx widened
- Hyoid bone moved up
- Epiglottis opened

Orthodontic Pearls Controversies

- Such outcome CAN NOT be compared to bone augmentation completed with corticotomy and grafted freeze-dried bone allograft material
- SARPE or MARPE and MSDO is by far better IMHO

Corticotomy & Grafted Freeze Dried Bone

- Mx dentoalveolar expansion
- Md dentoalveolar expansion into grafted bone
- Increase airway (?????)
  ✦ Buccal proclination
  ✦ Md forward position


What is New About Maxillary Expansion?

- New Hybrid Superscrew Device MARPE
- Tooth-Borne device + Le Fort 1 osteotomy
- Hybrid device + Le Fort 1 osteotomy
- Bicortical TAD Non Surgical Maxillary Skeletal Expansion

Parallel expansion of buccal segment
- Note the step out at the osteotomy cut
- Mx width gain 8.6 mm
- Nasal cavity width gain 6.6 mm

Larger skeletal expansion
Hybrid Hyrax

Early cases
✦ TADs too short (8 mm)
✦ 10-12 mm recommended to engage both palatal & nasal cortex
TADs should be place in the horizontal part of the palate
Expansion device in line or posterior to 1st molars

Miniscrew Assisted Rapid Palatal Expansion (MARPE)

4 mini-screw de 1,8 mm X 11 mm
MSE position: posterior palatal vault between 1st-2nd molars
Rate of activation MSE II
✦ Early teens: 6x/week (0,8 mm/Wk)
✦ Teens: 2x/day (0,27 mm/ day)
✦ Early to mid 20s: 4-6x/day (0,53-0,8 mm)
✦ Adult (>25-30): 4-6X/day minimum
After diastema: 2x/day (0,27 mm/day)

MARPE

Disengagement of pterygoid plate / pyramidal process
✦ 53% (16 sutures/30)
Skeletal expansion
✦ 71% et 63% of the screw changes
✓ (SARPE: 46%)

MARPE Skelettal Changes vs SARPE

MARPE Center of Rotation higher than SARPE
MARPE
✦ Maxilla move laterally
✓ Downward
✓ Forward
✦ Hemimaxillae: quasi parallel expansion
✓ Posterior part bend mediaily
SARPE

Dental Expansion

Skelettal Expansion

Mx: 5.7 mm
NC: 5.3 mm
1stM: 7 mm

Sk/Dt : 81%

Conclusion

Mandibular symphyseal distraction osteogenesis
✦ Effective to alleviate md crowding and maintain /1 AP relationship
✦ Small advancement of the mandible could be explained by outward rotation of the condyle in the fossa
✦ May improve airways by permitting the tongue to have room between dental arches

Monitoring expansion every week is mandatory. Every 3-4 days ideally
Conclusion

SARPE:
- Skeletal change is stable but account for only 46% at end of distraction

MARPE
- Skeletal change is about 70% of the screw change

MSDO
- Skeletal change is about 80% of the screw change. Relapse is NS

Therefore one should aim for skeletal change because it is stable

MSE & MSDO

Bicortical TAD MARPE
Hybrid Supercrew

Correct the Mx expansion with MSE device or Hybrid device
Mandibular Symphyseal Distraction Osteogenesis

Thank you
Do you have questions?