

Uprighting, Derotation and Protraction of Mandibular Second Molars into Severely Atrophic Alveolar Ridge Using Mini-Screw Implants

Quang L. Nguyen, DMD; Bryan E. Green, DMD, MDS; Luis P. Leite, DMD

Department of Pediatric Dentistry and Orthodontics
MEDICAL UNIVERSITY OF SOUTH CAROLINA, CHARLESTON, SC



ABSTRACT

Moving teeth into severely atrophied alveolar ridges with conventional Edgewise setups is problematic due to possible bone dehiscence, root resorption, and anchorage loss. This report describes successful bilateral up-righting and protraction of mandibular second molars into severely resorbed extraction sites using mini-screw implants as the main anchorage unit in a 59 year old woman.

Methods: The mini-screw implants were placed bilaterally in the buccal alveolar bone between first and second premolars. Nickel titanium springs were used to upright and derotate the second molars before protraction into atrophied extraction sites.

Results: The second molars were successfully up-righted by 10 months and spaces were closed at 18 months with good posterior occlusion. An increase in alveolar width was noted mesial to the second molars without any sign of root resorption.

Conclusions: Up-righting and protraction into atrophic sites using light, continuous forces from mini-screw implant anchorage is feasible.

LITERATURE SUMMARY

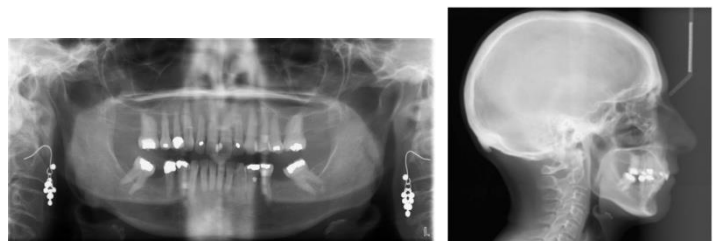
- > The periosteum on the labial and lingual surfaces will normally form bone if teeth are bodily moved slowly into the edentulous areas. If the teeth are moved too rapidly, there is a risk for development of a dehiscence.
- > When teeth move through an edentulous area, it is important to avoid tipping the tooth into the region. The root should, in principle, be moved ahead of the crown to build up bone by exerting a light pressure, thus increasing the density of the bone ahead of the tooth.
- > When a second molar is orthodontically protracted into an extraction site, the second molar will bring its own investing bone with it, and the large bony defect disappears. This is seen more readily in young patients. Older patients seem to have a decreased apposition of new alveolar bone.
- > Root resorption and dehiscence are concerns that are judged on a case-to-case basis.
- > Closed space tends to re-open post-treatment and is usually less than 1 mm.
- > Alveolar crest augmentation and bone grafting prior to orthodontic tooth movement have been recommended to minimize the above noted complications.
- > Patient may benefit from an Accelerated Osteogenic Orthodontic Procedure (Wilckodontics) prior to orthodontic tooth movement.

LITERATURE REFERENCES

1. K. Nagaraj, Titanium Screw Anchorage for Protraction of Mandibular Second Molars into First Molar Extraction Sites, Am. J. Orthod Dentofacial Orthop, 2008; 134: 583-91.
2. William R. Proffit, Contemporary Orthodontics, Fourth Edition, Chapter 18, Special Considerations in Treatment for Adults, 2007; p. 670-671.
3. Cacciafesta, JCO Interview Dr. Birte Melsen on Adult Orthodontic Treatment, JCO, December 2006; p. 703-16.
4. Taner, Tulin Ugur, Interdisciplinary Treatment of An Adult Patient with Old Extraction Sites. Angle Orthodontist, Vol 76, No 6, 2006; p. 1066-73.
5. Dr. Keim, JCO Interview Dr. Bjorn U. Zachrisson on Current Trends in Adult Treatment, JCO, May 2005; p. 285-296.
6. Wilcko MT, Full-thickness flap/subepithelial connective tissue grafting with intramarrow penetrations: three case reports of lingual root coverage. Int J Periodontics Restorative Dent., 2005, Dec. 25(6): 561-9
7. Elif Gunduz, Bone Regeneration by Bodily Tooth Movement: Dental Computed Tomography Examination of a Patient, Am J Ortho Dentofacial Orthop 2004; 125: 100-6.
8. Seung-Hyun Kyung, Miniscrew Anchorage Used to Protract Lower Second Molars into First Molar Extraction Sites, JCO, October, 2003; p.575-9.
9. Heinrich Wehrbein, Human Histologic Tissue Response After Long-Term Orthodontic Tooth Movement. Am J Orthod Dentofac Orthop 1995; 107: 360-71.
10. Efthimia K. Basdra, Guided Tissue Regeneration Precedes Tooth Movement and Crossbite Correction, Angle Orthodontist, Vol. 65 No 5, p 307-310, 1995
11. W. Eugene Roberts, Rigid Implant Anchorage to Close a Mandibular First Molar Extraction Site, Journal of Clinical Orthodontics, Vol.12, No 12 p. 693-704, 1994
12. W. Eugene Roberts, Rigid Endosseous Implant Utilized as Anchorage to Protract Molars and Close an Atrophic Extraction Site, The Angle Orthodontist, Vol. 60 No 2, p. 135-152
13. Barney M. Horn, The Effects of Space Closure of the Mandibular First Molar Area in Adults, Am J Ortho Dentofacial Orthop 1984; Vol 85, No 6: 457-69.
14. Micheal L. Stepovich, A Clinical Study on Closing Dentulous Spaces in the Mandible, The Angle Orthodontist, Vol. 49, No 4, 1979, p. 227-233

PRE-TREATMENT

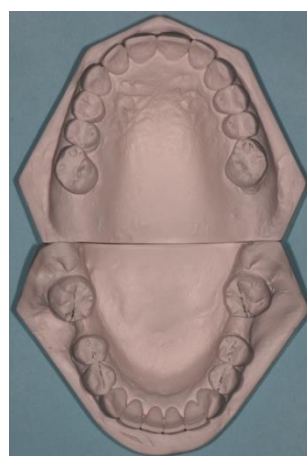
A 59 year old Caucasian female presented for improvement of her posterior occlusion. Historically, she lost all four 1st molars secondary to extensive decay when she was 14 years old. Her upper and lower 2nd molars were severely rotated, with the lower 2nd molars tipped mesially. The extraction sites of the lower first molars were severely atrophic. Skeletally, she was Class II with an ANB of 5.6°. Dentally, she had an end-on occlusion with a tendency toward Class II Div 2 with minimal crowding on the upper and lower arches. The patient also reported that she had received orthodontic treatment 11 years prior.



CEPHALOMETRIC MEASUREMENTS

SNA (°) = 80.8	FMA (°) = 24	U1-SN (°) = 84.6	L1-NB (mm) = 7.0	Nasolabial Angle (°) = 115.2
SNB (°) = 75.3	Y-Axis (°) = 73.2	U1-FH (°) = 97.3	L1-NB (°) = 30.2	Upper Lip to E-plane (mm) = -5.7
ANB (°) = 5.6	IMPA (°) = 88.3	U1-NA (mm) = 0.8	U1-L1 (°) = 140.4	Lower Lip to E-plane (mm) = -4.4
A-NA Perp (mm) = 3.7	FMA (°) = 57.7	U1-NA (°) = 3.8		

PRE-TREATMENT DENTAL CASTS



TREATMENT PLAN

A. TREATMENT OBJECTIVES

1. Improve patient's occlusion posteriorly
2. Establish/Enhance canine Class I
3. Coordinate upper & lower midlines to the face
4. Establish proper overbite, overjet, and anterior coupling

B. TREATMENT ALTERNATIVES

1. Comprehensive orthodontic treatment, uprighting of lower second molars, with restorative to replace lower first molars
2. Comprehensive orthodontic treatment with uprighting and protraction of lower second molars
 - a. Alveolar crest augmentation and bone grafting
 - b. Accelerated Osteogenic Orthodontic Procedure (Wilckodontics)
3. No treatment

TREATMENT PROGRESS

1. MOLAR UPRIGHTING BIOMECHANICS



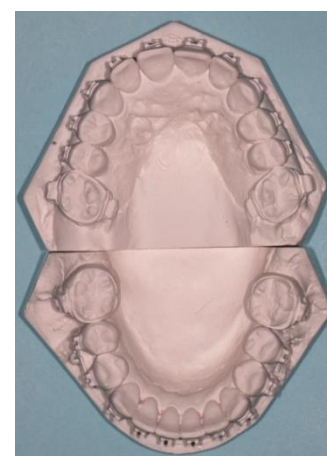
2. TAD PLACEMENT & SPRING ACTIVATION



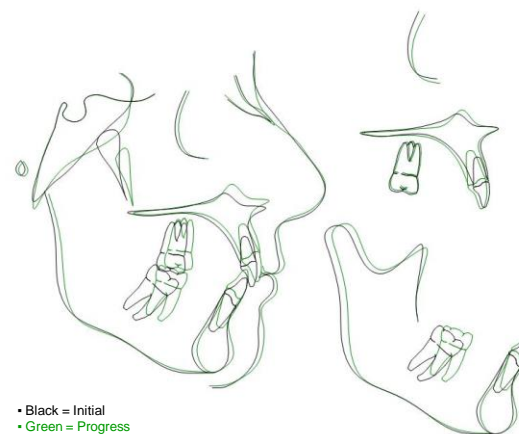
3. PROGRESS PHOTOS



4. PROGRESS CASTS

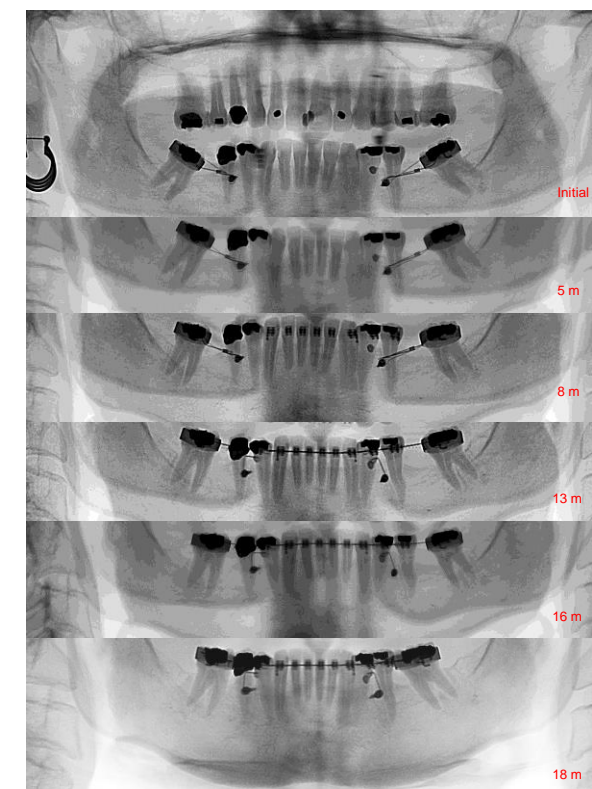


5. CEPHALOMETRIC SUPERIMPOSITIONS



• Black = Initial
• Green = Progress

6. PROGRESS PANORAMIC



7. BONY SCAN



DISCUSSIONS

1. Upper and lower second molars were successfully de-rotated. Lower second molars were successfully up-righted and protracted, closing all space at 18 months of treatment without root resorption.
2. On the CT scans, there is buccal and lingual cortical bone on the apical and middle areas of the roots. However, toward the coronal areas of the roots, there may be less than adequate cortical bone and possibly the potential for future dehiscence. This information is not conclusively useful due to not having a pre-treatment CT scan for comparison, and also due to the fact that there are root prominences on all her other teeth.
3. Lower molars ideally should be up-righted beyond vertical position to enhance mesial root positioning and associated bone width in preparation for protracting the molars into the extraction sites.
4. Class I molar and canine are established on the left side. The right side is end-on and a TAD is treatment planned to be placed in the infra-zygoma to distalize the whole segment.
5. Post-treatment considerations are relapse due to supra-crestal fibers and the possibility for periodontal involvement.
6. Patient may have benefitted from alveolar crest augmentation and bone graft of the atrophic sites or Accelerated Osteogenic Orthodontic Procedures prior to orthodontic tooth movement.
7. Patient's experience with TAD is positive with no complications. Patient is very happy with the results achieved thus far.

ACKNOWLEDGEMENT

Special thank to Dr. Courtney W. Shelbourne and Dr. Craig H. Rhyne Jr. for providing the bony scan on patient. Also I would like to thank to Professor Axel Bumann for his molar up-righting mechanics using TOMAS.