

Early Management of Impacted Maxillary Incisors with Skeletal Anchorage

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Maxillary central incisor impaction is relatively uncommon, at a rate of only .06-.2%,¹ but can be problematic for the clinician when encountered.²⁻⁴ Treatment options include orthodontic eruption of the impacted tooth,⁵⁻⁷ extraction of the impacted tooth and restoration of the retained space after growth has ceased,⁸ and surgical repositioning of the impacted incisor.⁹ In addition, various authors have reported successful extraction of the impacted central incisor and replacement with an autotransplanted premolar^{10,11} or with the adjacent lateral incisor after prosthetic restoration.²

Orthodontic traction of the patient's own impacted tooth appears to be the preferred treatment, although it may be more time consuming and carries the risks of pulp devitalization, ankylosis, and root resorption.^{12,13} A further challenge

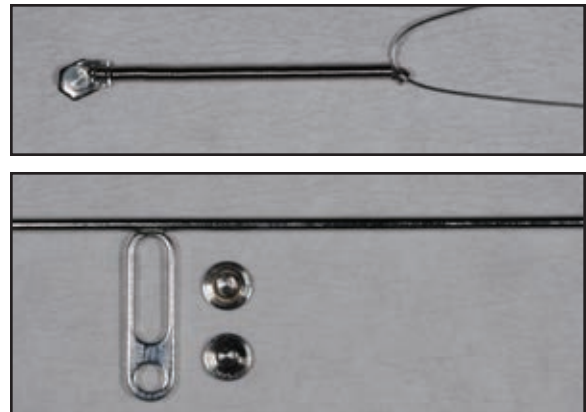


Fig. 1 A. Easy-Way-Coil (EWC*) system. B. Bone-plate with two abutment screws.**

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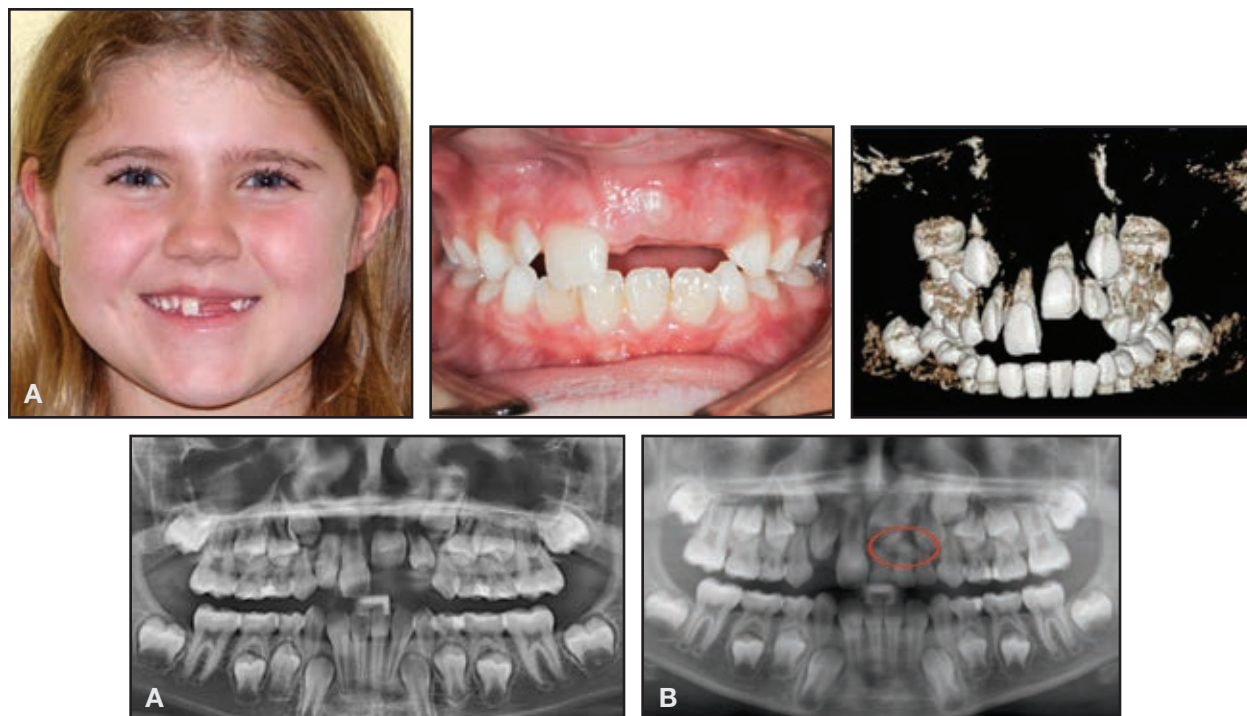


Fig. 2 A. 9-year-old female patient with impacted upper left central and lateral incisors before treatment. B. Nine months earlier, supernumerary tooth detected between central and lateral incisors and surgically removed.

lies in the design of appropriate mechanics for eruption of an impacted central incisor, especially if the patient is not ready for comprehensive orthodontic treatment.

The Easy-Way-Coil (EWC*) system—consisting of a stainless steel coil spring, an orthodontic attachment, and a stainless steel ligature wire—was introduced in 2008 as an alternative means of applying a continuous eruptive force to an impacted tooth^{14,15} (Fig. 1A). Although it is easily inserted and activated, the EWC, like similar techniques, was designed for use with a base archwire. We have found palatal anchorage to be an effective alternative to a rigid, full-arch orthodontic wire or a Nance holding arch, improving force control while minimizing side effects on the adjacent teeth.^{16,17} Overall treatment time can be significantly reduced because the impaction is corrected independently in an initial phase. Compre-

hensive treatment with full-arch fixed appliances can then be performed when the patient is more dentally mature.¹⁸

This article presents a case in which the Beneplate** skeletal anchorage system^{19,20} (Fig. 1B) was used in combination with the EWC to erupt an impacted central incisor.

Case Report

A 9-year-old female presented with impacted upper left central and lateral incisors (Fig. 2A). A supernumerary between these two teeth had been diagnosed radiographically (Fig. 2B) and surgi-

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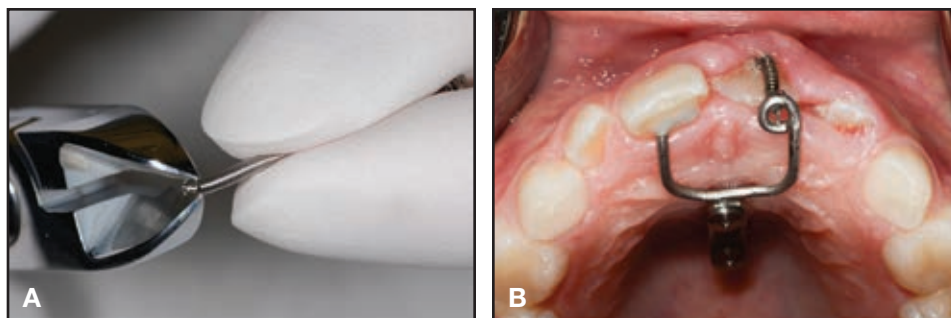


Fig. 3 A. Formation of eyelet at distal end of EWC spring. B. Activated EWC in place.

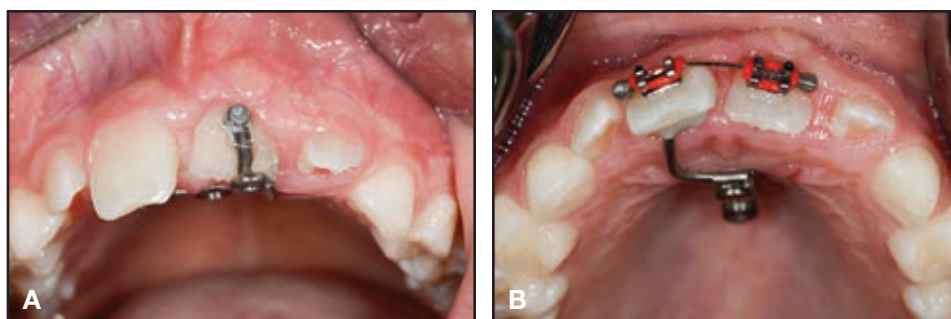


Fig. 4 A. Incisal edge of central incisor in contact with anchor loop of Beneplate after 14 weeks of activation. B. Anchor wire removed and brackets bonded to labial surfaces of central and lateral incisors to continue eruption.

cally removed nine months earlier. The follow-up radiograph confirmed some improvement in the vertical position of the affected incisors, but since both teeth had failed to erupt, it was decided to proceed with active orthodontic eruption.

The plan was to combine the EWC with a Beneplate attached to two orthodontic mini-implants in the median suture, at the level of the second and third palatal rugae. Prior to insertion of the Beneplate, its .045" wire ends were cut and bent medially into a "U" shape. One leg was shortened, and a helical loop was bent distally to serve as an anchor point for traction of the impacted upper left central incisor. The plate was then attached intraorally, and the .045" wire leg on the right side was bonded to the palatal surface of the fully erupted right central incisor.

After the impacted central incisor was exposed by means of an apically positioned flap,²¹

the EWC's bondable attachment was affixed to the tooth's labial surface between the middle and incisal thirds of the crown. The EWC spring was then connected passively to the helical loop at the free end of the Beneplate.

One week after surgical exposure, the sutures were removed, and the closed-coil spring was cut 1mm short of the Beneplate's helical wire loop. A ligature cutter was used to carefully bend the last three threads of the spring, forming a small eyelet (Fig. 3A). This eyelet was attached to the helical loop of the Beneplate with a ligature wire (Fig. 3B). The 1mm activation delivered about 15cN of force.¹⁴

Four weeks later, the coil was recut and a new eyelet was bent to produce another 1mm of activation. These activations were repeated every four weeks until the incisal edge of the impacted incisor contacted the anchoring helical loop (Fig.

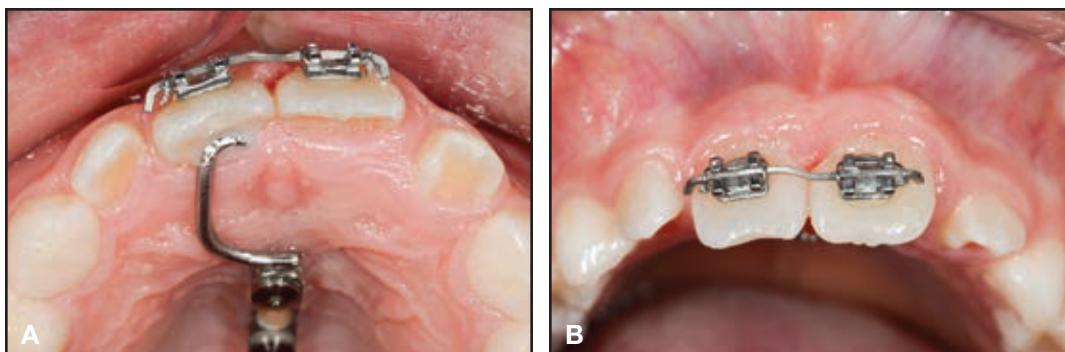


Fig. 5 A. Detailing with .017" x .025" TMA*** sectional wire. B. Bends placed in archwire for final positioning.



Fig. 6 Patient after six months of treatment, showing spontaneous eruption of impacted upper left lateral incisor.

4A). At this point, the looped wire leg of the Beneplate was removed with a coarse diamond bur. One week later, orthodontic brackets were bonded to the labial surfaces of both upper central incisors, and an .016" round superelastic sectional wire was inserted to complete eruption of the central incisor (Fig. 4B).

Once the desired vertical tooth position was achieved, an .017" x .025" TMA*** sectional wire was inserted to provide torque control of the central incisor (Fig. 5A). Minor bends were placed in the archwire for final tooth positioning (Fig. 5B).

Total treatment time between surgical exposure and debonding was six months. At the end of

treatment, the impacted upper left lateral incisor had erupted spontaneously (Fig. 6).

Discussion

In a case such as the one shown here, the non-ligated leg of the Beneplate should be bonded to the palatal surface of the overerupted adjacent central incisor to prevent further eruption and thus reduce the tendency toward a gummy smile (Fig. 7A). If the patient exhibits a flat smile and therefore requires elongation of the incisors, the

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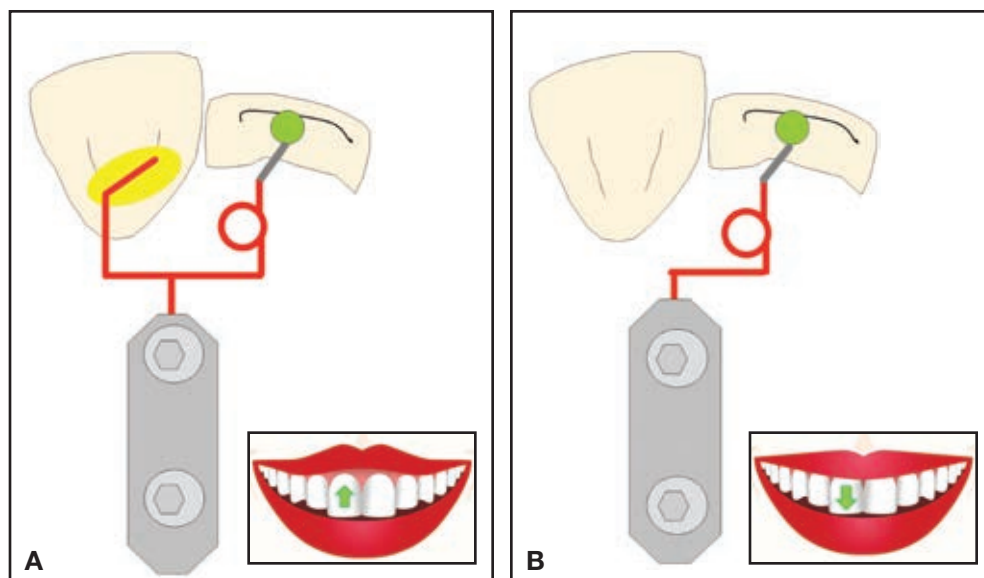


Fig. 7 A. Bonding of non-ligated Beneplate wire leg prevents overerupted upper right central incisor from erupting further, thus alleviating gummy smile tendency. **B.** With wire unbonded, upper right central incisor can erupt freely, facilitating esthetic smile arc in patient with flat smile.

non-ligated leg should not be bonded to the adjacent incisor, allowing it to erupt freely and facilitating the establishment of an esthetic smile arc (Fig. 7B).

Depending on the severity and location of the impaction, orthodontic mini-implants can be used as direct or indirect anchorage for orthodontic eruption of impacted teeth.²²⁻²⁵ Using a Beneplate as an anchor unit eliminates the need for fixed appliances and a rigid upper archwire while preventing unwanted side effects on the teeth adjacent to the impaction. Inserting the mini-implants in the anterior palate ensures stability of the anchor unit, which is atraumatic and comfortable for the patient.²⁶⁻²⁸ Previous studies have demonstrated a high success rate for mini-implants in the anterior palate due to the quantity of bone and favorable mucosal tissue.²⁹ The appliance's rigidity and its distance from the occlusal surfaces provide adequate protection against masticatory forces and toothbrushing; similar appliances using TMA cantilever wires have been reported to distort easily and therefore result in longer treatment.²⁵

The combination of the Beneplate and EWC systems provides excellent control of treatment mechanics with simple activations. Shortening the EWC spring by 1mm (three threads) at every activation visit generates a standardized force of 15.8cN,¹⁴ enough to produce eruptive movement without increasing the risk of adverse effects such as external root resorption.³⁰⁻³² The technique shown here is recommended primarily for young patients who are not dentally mature enough for comprehensive treatment with fixed orthodontic appliances.

REFERENCES

1. Grover, P.S. and Lorton, L.: The incidence of unerupted permanent teeth and related clinical cases, *Oral Surg. Oral Med. Oral Pathol.* 59:420-425, 1985.
2. Kokich, V.G. and Crabill, K.E.: Managing the patient with missing or malformed maxillary central incisors, *Am. J. Orthod.* 129:S55-63, 2006.
3. Pavlidis, D.; Daratsianos, N.; and Jager, A.: Treatment of an impacted dilacerated maxillary central incisor, *Am. J. Orthod.* 139:378-387, 2011.
4. Pinho, T.: Impaction of both maxillary central incisors and a canine, *Am. J. Orthod.* 142:374-383, 2012.

5. Rizzato, S.M.; de Menezes, L.M.; Allgayer, S.; Batista, E.L. Jr.; Freitas, M.P.; and Loro, R.C.: Orthodontically induced eruption of a horizontally impacted maxillary central incisor, *Am. J. Orthod.* 144:119-129, 2013.
6. Pinho, T.; Neves, M.; and Alves, C.: Impacted maxillary central incisor: Surgical exposure and orthodontic treatment, *Am. J. Orthod.* 140:256-265, 2011.
7. Valladares Neto, J.; de Pinho Costa, S.; and Estrela, C.: Orthodontic-surgical-endodontic management of unerupted maxillary central incisor with distoangular root dilacerations, *J. Endod.* 36:755-759, 2010.
8. Kokich, V.G. and Spear, F.M.: Guidelines for managing the orthodontic-restorative patient, *Semin. Orthod.* 3:3-20, 1997.
9. Tsai, T.P.: Surgical repositioning of an impacted dilacerated incisor in mixed dentition, *J. Am. Dent. Assoc.* 133:61-66, 2002.
10. Paulsen, H.U.; Shi, X.Q.; Welander, U.; Huggare, J.; and Scheutz, F.: Eruption pattern of autotransplanted premolars visualized by radiographic color-coding, *Am. J. Orthod.* 119:338-345, 2001.
11. Czochrowska, E.M.; Stenvik, A.; Album, B.; and Zachrisson, B.U.: Autotransplantation of premolars to replace maxillary incisors: A comparison with natural incisors, *Am. J. Orthod.* 118:592-600, 2000.
12. Topouzelis, N.; Tsaousoglou, P.; Pisoka, V.; and Zouloumis, L.: Dilaceration of maxillary central incisor: A literature review, *Dent. Traumatol.* 26:427-433, 2010.
13. Frank, C.A. and Long, M.: Periodontal concerns associated with the orthodontic treatment of impacted teeth, *Am. J. Orthod.* 121:639-649, 2002.
14. Schubert, M.: A new technique for forced eruption of impacted teeth, *J. Clin. Orthod.* 42:175-179, 2008.
15. Schubert, M.: The alignment of impacted and ectopic teeth using the Easy-Way-Coil (EWC) System, *J. Orofac. Orthop.* 69:213-226, 2008.
16. Ludwig, B.; Baumgaertel, S.; and Bowman, S.J.: *Mini-Implants in Orthodontics: Innovative Anchorage Concepts*, Quintessence, London, 2008.
17. Ludwig, B.; Glasl, B.; Bowman, S.J.; Wilmes, B.; Kinzinger, G.S.; and Lisson, J.A.: Anatomical guidelines for miniscrew insertion: Palatal sites, *J. Clin. Orthod.* 45:433-441, 2011.
18. Chaushu, S. and Chaushu, G.: Skeletal implant anchorage in the treatment of impacted teeth—a review of the state of the art, *Semin. Orthod.* 16:234-241, 2010.
19. Wilmes, B. and Drescher, D.: A miniscrew system with interchangeable abutments, *J. Clin. Orthod.* 42:574-580, 2008.
20. Nienkemper, M.; Wilmes, B.; Pauls, A.; and Drescher, D.: Multipurpose use of orthodontic mini-implants to achieve different treatment goals, *J. Orofac. Orthop.* 73:467-476, 2012.
21. Kokich, V.G.: Surgical and orthodontic management of impacted maxillary canines, *Am. J. Orthod.* 126:278-283, 2004.
22. Kocsis, A. and Seres, L.: Orthodontic screws to extrude impacted maxillary canines, *J. Orofac. Orthop.* 73:19-27, 2012.
23. Tseng, Y.C.; Chen, C.M.; and Chang, H.P.: Use of a miniplate for skeletal anchorage in the treatment of a severely impacted mandibular second molar, *Br. J. Oral Maxillofac. Surg.* 46:406-407, 2008.
24. Park, W.; Park, J.S.; Kim, Y.M.; Yu, H.S.; and Kim, K.D.: Orthodontic extrusion of the lower third molar with an orthodontic mini implant, *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 110:31, 2010.
25. Nienkemper, M.; Wilmes, B.; Ludwig, B.; Pauls, A.; and Drescher, D.: Klinische Untersuchung skelettal verankerten Mechaniken zur Einordnung retinierter Zähne, *Kieferorthop.* 26:7-17, 2012.
26. Wilmes, B.; Drescher, D.; and Nienkemper, M.: A miniplate system for improved stability of skeletal anchorage, *J. Clin. Orthod.* 43:494-501, 2009.
27. Kim, Y.H.; Yang, S.M.; Kim, S.; Lee, J.Y.; Kim, K.E.; Gianelly, A.A.; and Kyung, S.H.: Midpalatal miniscrews for orthodontic anchorage: Factors affecting clinical success, *Am. J. Orthod.* 137:66-72, 2010.
28. Lim, H.J.; Eun, C.S.; Cho, J.H.; Lee, K.H.; and Hwang, H.S.: Factors associated with initial stability of miniscrews for orthodontic treatment, *Am. J. Orthod.* 136:236-242, 2009.
29. Ludwig, B.; Glasl, B.; Kinzinger, G.S.; Lietz, T.; and Lisson, J.A.: Anatomical guidelines for miniscrew insertion: Vestibular interradicular sites, *J. Clin. Orthod.* 45:165-173, 2011.
30. Quinn, R.S. and Yoshikawa, D.K.: A reassessment of force magnitude in orthodontics, *Am. J. Orthod.* 88:252-260, 1985.
31. Kurol, J.; Owman-Moll, P.; and Lundgren, D.: Time-related root resorption after application of a controlled continuous orthodontic force, *Am. J. Orthod.* 110:303-310, 1996.
32. Owman-Moll, P.; Kurol, J.; and Lundgren, D.: The effects of a four-fold increased orthodontic force magnitude on tooth movement and root resorptions: An intra-individual study in adolescents, *Eur. J. Orthod.* 18:287-294, 1996.