

Intentional Ankylosis of Deciduous Canines to Reinforce Maxillary Protraction

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Maxillary deficiency, either isolated or associated with mandibular prognathism, tends to be the main facial characteristic of Class III malocclusions.¹⁻¹⁶ Many orthodontists prefer early treatment in such cases to obtain the best orthopedic results and post-treatment stability. One of the most common non-surgical treatment modalities involves rapid maxillary expansion with a Haas-type expander,¹⁷⁻²⁴ followed by maxillary protraction with a facial mask.²³⁻²⁶

We have developed a new treatment protocol for Class III malocclusion with maxillary deficiency, involving extraction and replantation of the upper deciduous canines to cause ankylosis for temporary static anchorage prior to rapid maxillary expansion and protraction.

Rationale

Replantation of teeth after dental avulsion usually causes ankylosis.^{27,28} Intentional extraction and subsequent replantation of teeth have

also consistently caused ankylosis in experimental animals.²⁹⁻³⁴ Studies have shown that ankylosed teeth can provide stable anchorage for transverse orthopedic movement of the maxilla.³⁵⁻³⁸ However, intentional ankylosis of canines for orthodontic movement is still treated with understandable reservation because of its cost-benefit relationship.³⁹⁻⁴¹

We selected the upper deciduous canines to undergo intentional ankylosis and serve as anchorage for the following reasons:

- With deciduous teeth, intentional ankylosis simply encourages the genetically programmed process known as replacement resorption. Permanent teeth are not suitable because they cannot be removed after the procedure.
- Although root replacement resorption tends to limit treatment time, the longer roots of the canines offer an adequate working time of about a year. In addition, deciduous canines tend to exfoliate later than the posterior deciduous teeth, and the upper permanent canines generally erupt



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Fig. 1 7-year-old female patient with Class III malocclusion and anterior crossbite before treatment.



Fig. 2 Early orthopedic treatment with facial mask after intentional ankylosis of upper deciduous canines and rapid maxillary expansion.

after the first premolars.

- Deciduous canines have only one root, which facilitates the extraction, endodontic, and replantation procedures.
- From a biomechanical point of view, deciduous canines are strategically positioned in the anterior part of the maxilla, allowing parallel advancement in relation to the occlusal and palatal planes during protraction.

Surgical Procedure

1. The deciduous canines are extracted as usual under local anesthesia, with care taken to preserve alveolar integrity during their removal.
2. The remaining periodontal ligament is completely removed by scraping the roots with curettes and gauze and the alveolus with curettes only. Studies have shown this to be an important step, in that a replanted tooth with no periodontal ligament generally becomes ankylosed within 30 days.³¹⁻³⁴
3. Endodontic treatment of the extracted canines is performed so that resorption will not occur under inflammatory osteolysis or in the presence of abscess. A resorbable paste made of zinc oxide (three parts), iodoform (one part), and eugenol (vehicle) is used to fill the root canal.
4. The teeth are kept out of the alveolus long enough that any persistent periodontal ligament fibers will be thoroughly desiccated. Recommended times vary from 15 minutes⁴² to 40 minutes⁴³ to one hour.³⁰ Because our patients were young children, many of whom had never been anesthetized, the average time that teeth remained out of the alveolus was 40 minutes. This allowed us to eliminate the surgical discomfort as soon as possible.
5. The teeth are rinsed with a physiologic solution, dried with gauze, and replaced in their alveola under digital pressure.
6. Rigid retention is provided by the fixed maxillary expander, which is fabricated with hooks to attach the elastics for maxillary protraction. The appliance is cemented in place immediately after replantation of the deciduous canines.
7. The replanted teeth are immobilized with the

expander for 40-60 days prior to activation of the expansion screw. Experiments have shown that the periodontal ligament is replaced by bone within eight weeks after replantation.³³

8. Periapical radiographs of the replanted canines are taken before, immediately after, and 60 days after surgery for added security.

Case Report

A 7-year-old female in the early mixed dentition presented with a Class III malocclusion, with anterior crossbite and little dental compensation (Fig. 1). Intentional ankylosis of the upper deciduous canines, as described above, was followed by a two-month retention period using the maxillary expander. Conventional Class III treatment was then initiated, with rapid maxillary expansion immediately followed by maxillary protraction with a facial mask^{23,39,44} (Fig. 2).

One year later, the facial mask was discontinued, and a notable improvement in facial appearance could be seen (Fig. 3).

Discussion

The following factors should be taken into account when considering intentional ankylosis of the deciduous canines to enhance maxillary protraction:

- The patient's and parents' cooperation.
- The presence of a Class III malocclusion with maxillary deficiency and without excessive lower anterior facial height or evident dental compensation.
- The patient's stage of dental development. In the deciduous or early mixed dentition, the roots of the deciduous canines are usually sound enough for the required length of maxillary protraction.
- The patient's oral, and particularly periodontal, health.
- Concurrence of the oral surgeon and endodontist.

Intentional ankylosis has a number of advantages:

- Replanted deciduous canines are biocompati-

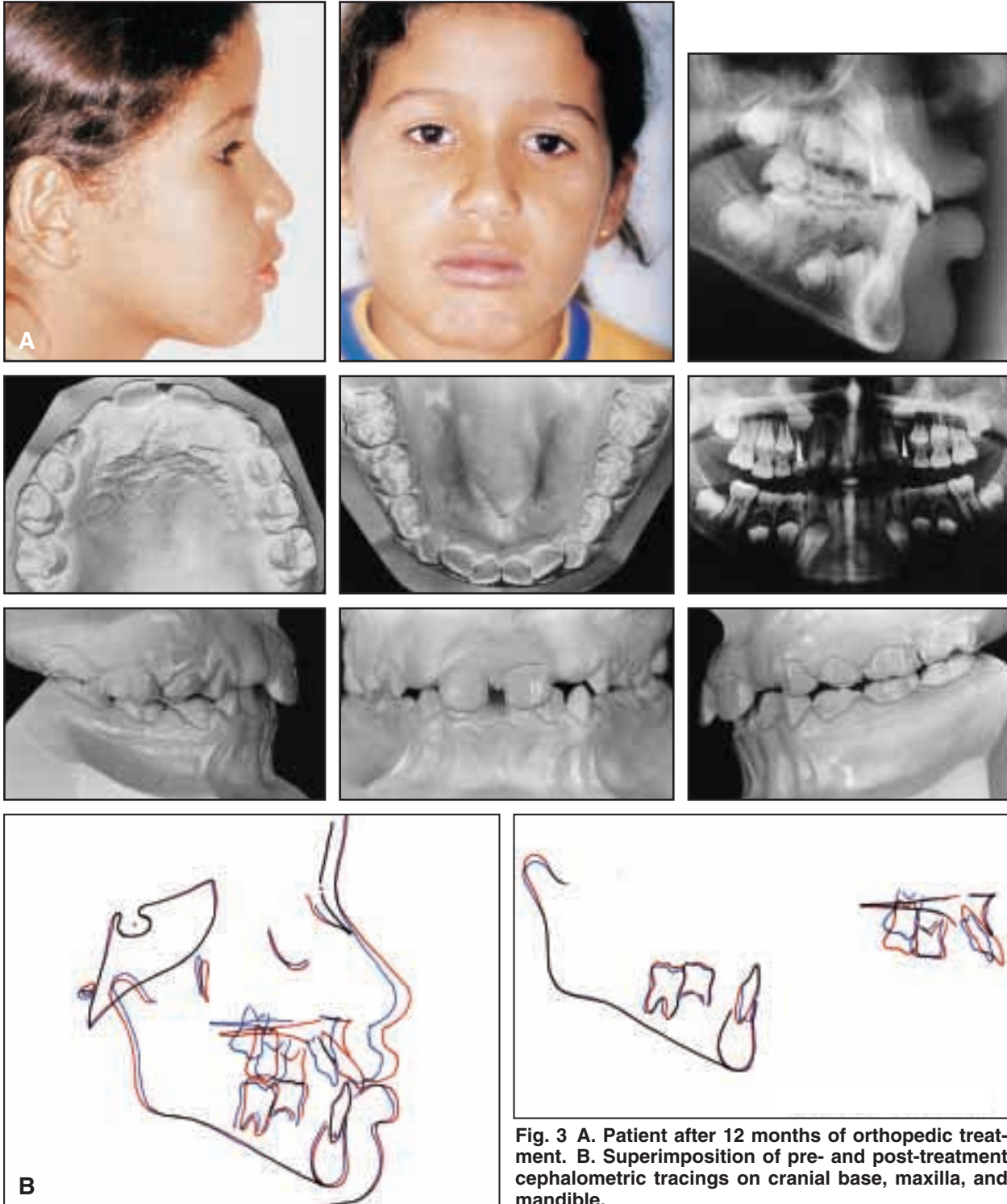


Fig. 3 A. Patient after 12 months of orthopedic treatment. B. Superimposition of pre- and post-treatment cephalometric tracings on cranial base, maxilla, and mandible.

ble, autogenous implants that will undergo root resorption without the need to be extracted after maxillary protraction is completed.

- Replanted teeth provide rigid and static anchorage, allowing the maximum orthopedic effect with little dental compensation.
- The cost is low, and risk to the patient is minimal, compared to osseointegrated titanium implants.
- The procedure is well accepted by patients and parents.

REFERENCES

1. Silva Filho, O.G.; Silva, P.R.B.; Rego, M.V.N.N.; Silva, F.P.L.; and Cavassan, A.O.: Epidemiologia da má oclusão na dentadura decídua, *Ortod.* 35:22-33, 2002.
2. Silva Filho, O.G.; Freitas, S.F.; and Cavassan, A.O.: Prevalência de oclusão normal e má oclusão em escolares da cidade de Bauru (São Paulo), I. Relação sagital, *Rev. Fac. Odontol. São Paulo* 4:130-137, 1990.
3. Ast, D.B.; Carlos, J.P.; and Cons, N.C.: The prevalence and characteristics of malocclusion among senior high school students in upstate New York, *Am. J. Orthod.* 51:437-445, 1965.
4. Björk, A.: The face in profile: An anthropological X-ray investigation of Swedish children and conscripts, *Berlingska Boktryckeriet* 40:58, 1947.
5. Foster, T.D. and Day, A.J.: A survey of malocclusion and the need for orthodontic treatment in a Shropshire school population, *Br. J. Orthod.* 1:73-78, 1974.
6. Huber, R.E. and Reynolds, J.W.: A dentofacial study of male students at the University of Michigan in the physical hardening program, *Am. J. Orthod.* 32:1-21, 1946.
7. Humphreys, H.F. and Leighton, B.C.: A survey of antero-posterior abnormalities of the jaws in children between the ages of two and five-and-a-half years of age, *Br. Dent. J.* 88:3-15, 1950.
8. Massler, M. and Frankel, J.M.: Prevalence of malocclusion in children aged 14 to 18 years, *Am. J. Orthod.* 37:751-768, 1951.
9. Newman, G.V.: Prevalence of malocclusion in children six to fourteen years of age and treatment in preventable cases, *J. Am. Dent. Assoc.* 52:566-575, 1956.
10. Thilander, B. and Myrberg, N.: The prevalence of malocclusion in Swedish school children, *Scand. J. Dent. Res.* 81:12-21, 1973.
11. Allwright, W.C. and Burndred, W.H.: A survey of handicapping dentofacial anomalies among Chinese in Hong Kong, *Int. Dent. J.* 14:505-519, 1964.
12. Irie, M. and Nakamura, S.: Orthopedic approach to severe skeletal Class III malocclusion, *Am. J. Orthod.* 67:377-392, 1975.
13. Iwagaki, H.: Hereditary influence of malocclusion, *Am. J. Orthod. Oral Surg.* 24:328-336, 1938.
14. Ellis, E. III and McNamara, J.A. Jr.: Components of adult Class III open-bite malocclusion, *Am. J. Orthod.* 86:277-290, 1984.
15. Jacobson, A.; Evans, W.G.; Preston, C.B.; and Sadowsky, P.L.: Mandibular prognathism, *Am. J. Orthod.* 66:140-171, 1974.
16. Silva Filho, O.G.; Magro, A.C.; and Ozawa, T.O.: Má oclusão de classe III: Caracterização morfológica na infância (dentaduras decídua e mista), *Ortod.* 30:7-20, 1997.
17. Haas, A.J.: Palatal expansion: Just the beginning of dentofacial orthopedics, *Am. J. Orthod.* 57:219-255, 1970.
18. Baik, H.S.: Clinical results of the maxillary protraction in Korean children, *Am. J. Orthod.* 108:583-592, 1995.
19. Mermigos, J.; Full, C.A.; and Andreasen, G.: Protraction of the maxillofacial complex, *Am. J. Orthod.* 98:47-55, 1990.
20. Ngan, P.; Wei, S.H.; Hagg, U.; Yiu, C.K.; Merwin, D.; and Stickel, B.: Effect of protraction headgear on Class III malocclusion, *Quintess. Int.* 23:197-207, 1992.
21. Ngan, P.; Hagg, U.; Yiu, C.; Merwin, D.; and Wei, S.H.Y.: Treatment response to maxillary expansion and protraction, *Eur. J. Orthod.* 18:151-168, 1996.
22. Ngan, P.; Hagg, U.; Yiu, C.; Merwin, D.; and Wei, S.H.Y.: Soft tissue and dentoskeletal profile changes associated with maxillary expansion and protraction headgear treatment, *Am. J.*

- Orthod. 109:38-49, 1996.
23. Silva Filho, O.G.; Magro, A.C.; and Capelozza Filho, L.: Early treatment of the Class III malocclusion with rapid maxillary expansion and maxillary protraction, *Am. J. Orthod.* 113:196-203, 1998.
 24. Turley, P.K.: Orthopedic correction of Class III malocclusion with palatal expansion and custom protraction headgear, *J. Clin. Orthod.* 22:314-325, 1988.
 25. Silva Filho, O.G.; Rufino, E.S.; Okada, T.; and Magro, A.C.: Correção da má oclusão de Classe III com ortopedia mecânica, *Rev. Soc. Paran. Ortod.* 1:15-30, 1997.
 26. Williams, M.D.; Sarver, D.M.; Sadowsky, P.L.; and Bradley, E.: Combined rapid maxillary expansion and protraction face-mask in the treatment of Class III malocclusions in growing children: A prospective long-term study, *Semin. Orthod.* 3:265-274, 1997.
 27. Anderson, L.: Dentoalveolar ankylosis and associated root resorption in replanted teeth: Experimental and clinical studies in monkeys and man, *Swed. Dent. J. Suppl.* 56:1-75, 1988.
 28. Andreasen, J.O. and Hjørting-Hansen, E.: Replantation of teeth, I. Radiographic and clinical study of 110 human teeth replanted after accidental loss, *Acta Odontol. Scand.* 24:263-286, 1966.
 29. Biederman, W.: Etiology and treatment of tooth ankylosis, *Am. J. Orthod.* 48:670-683, 1962.
 30. Hammarström, L.; Blomlöf, L.; and Lindskog, S.: Dynamics of dentoalveolar ankylosis and associated root resorption, *Endod. Dent. Traumatol.* 5:163-175, 1989.
 31. Hamner, J.E.; Reed, O.M.; and Stanley, H.R.: Reimplantation of teeth in the baboon, *J. Am. Dent. Assoc.* 81:662-670, 1970.
 32. Lindskog, S.; Pierce, A.M.; Blomlöf, L.; and Hammarström, L.: The role of the necrotic periodontal membrane in cementum resorption and ankylosis, *Endod. Dent. Traumatol.* 1:96-101, 1985.
 33. Löe, H. and Waerhaug, J.: Experimental replantation of teeth in dogs and monkeys, *Arch. Oral Biol.* 3:176-184, 1961.
 34. Sherman, P. Jr.: Intentional replantation of teeth in dogs and monkeys, *J. Dent. Res.* 47:1066-1071, 1968.
 35. Guyman, G.W.; Kokich, V.G.; and Oswald, R.J.: Ankylosed teeth as abutments for palatal expansion in the rhesus monkey, *Am. J. Orthod.* 77:486-499, 1980.
 36. Ozawa, T.O.; Ogeda, P.C.; Capelozza Filho, L.; Silva Filho, O.G.; and Cavassan, A.O.: Anquiloze dental intencional: Um recurso de ancoragem na clínica ortodôntica, *Ortod.* 30:60-68, 1997.
 37. Kokich, V.G.; Shapiro, P.A.; Oswald, R.; Koskinen-Moffett, L.; and Clarren, S.K.: Ankylosed teeth as abutments for maxillary protraction: A case report, *Am. J. Orthod.* 88:303-307, 1985.
 38. Omnell, M.L. and Sheller, B.: Maxillary protraction to intentionally ankylosed deciduous canines in patient with cleft palate, *Am. J. Orthod.* 106:201-205, 1994.
 39. Biederman, W.: The problem of the ankylosed tooth, *Dent. Clin. N. Am.* 12:409-424, 1968.
 40. Silva Filho, O.G.; Normando, A.D.C.; and Valladares Neto, J.: Infra-oclusão de molares decíduos: Apresentação de uma conduta clínica racional, *Rev. Bras. Odontol.* 49:2-7, 1992.
 41. Sheller, B. and Omnell, L.: Therapeutic ankylosis of primary teeth, *J. Clin. Orthod.* 25:499-502, 1991.
 42. Söder, P.O.; Otteskog, P.; Andreasen, J.O.; and Modeer, T.: Effect of drying on viability of periodontal membrane, *Scand. J. Dent. Res.* 85:164-168, 1977.
 43. Cvek, M.; Granath, L.E.; and Hollender, L.: Treatment of non-vital permanent incisors with calcium hydroxide, III. Variation of occurrence of ankylosis of reimplanted teeth with duration of extra-alveolar period and storage environment, *Odontol. Revy.* 25:43-56, 1974.
 44. Silva Filho, O.G.; Santos, S.C.B.N.; and Suguimoto, R.M.: Má oclusão de Classe III: Época oportuna de tratamento, *Ortod.* 28:74-84, 1995.

