

Multidisciplinary Management of Double-Tooth Anomalies

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A double tooth is a congenital anomaly in which two adjacent teeth are joined at the crown level (enamel and dentin), forming a single tooth with an enlarged crown.¹ Although the cause is unknown, genetic factors may be involved in some cases.²⁻⁴ The prevalence of the defect is approximately .1% in the permanent dentition and .5% in the deciduous dentition, with no predominance of males vs. females.^{5,6}

A proposed classification distinguishes among four categories of the condition.¹⁻⁷ “Gemination” refers to the incomplete attempt of one tooth germ to divide into two.⁸ Geminated teeth have two crowns or one large, partially separated crown sharing a single root or root canal; the maxillary permanent incisors and the mandibular deciduous incisors are most often affected.⁹ The union of a supernumerary tooth and a normal tooth is referred to as “diphyodontic gemination”.⁷ Although “twinning” is sometimes used as a synonym for gemination, it actually means complete cleavage of the tooth bud, resulting in the forma-

tion of an extra tooth that is usually a mirror image of its partner. “Fusion” is defined as a complete or partial union between the dentin of two or more teeth, resulting in fewer teeth in the dental arch.^{7,10} Finally, “concrecence” refers to the union of two completely separate teeth by a deposit of cementum after the formation of crowns.^{7,8}

Any double-tooth deformity—particularly if it involves anterior teeth—presents clinical challenges such as crowding, compromised esthetics, and plaque accumulation secondary to surface notching.^{11,12} Dental alignment, occlusion, arch symmetry, and periodontal health may also be affected.^{13,14}

Although differential diagnosis can be difficult, the most important distinction for clinical purposes is whether there is a single root canal, a single pulp chamber divided into two root canals, or two independent endodontic systems.^{9,10,15} A multidisciplinary treatment approach yields the best possible esthetic and functional outcome, as shown in the case below.¹⁶⁻¹⁸



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Case Report

Diagnosis and Treatment Plan

A 13-year-old male was referred to the orthodontic department of the University of Naples Federico II for evaluation and treatment. He complained of an anomalous shape of the maxillary right central incisor and resulting esthetic and functional problems. There was no history of orofacial trauma.

The patient was in the late mixed dentition

and demonstrated fair oral hygiene and good periodontal health (Fig. 1). Clinical examination revealed a Class I malocclusion with mild crowding in the mandibular arch (-2mm) and severe crowding in the maxillary arch (-8mm). The overbite was 4mm; the overjet was 5mm. The maxillary central incisors were labially inclined, and the midline was shifted by 2mm to the left. The right maxillary central incisor was anomalous, with a mesiodistal crown width of 15mm and a marked labial and palatal groove dividing the

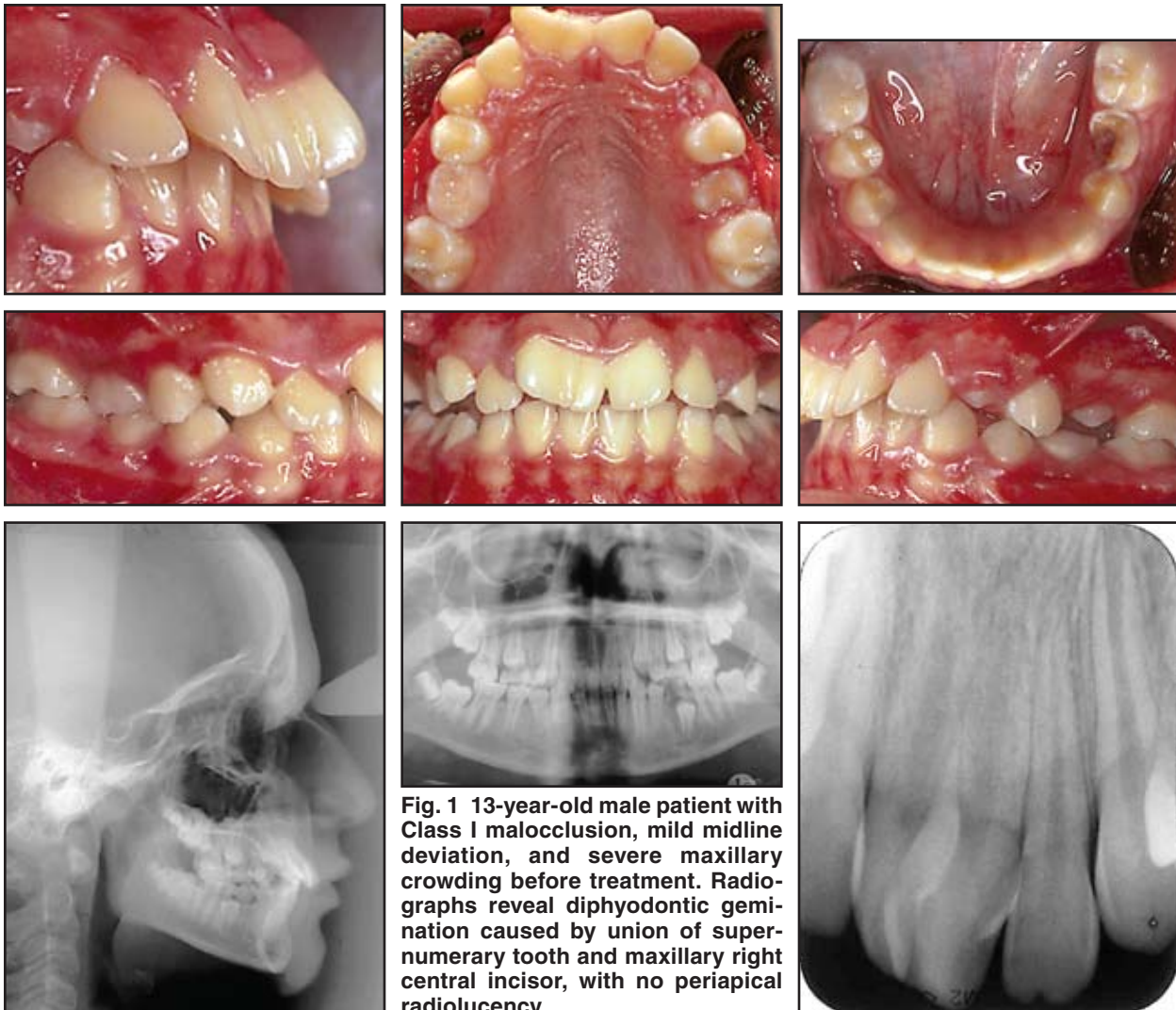


Fig. 1 13-year-old male patient with Class I malocclusion, mild midline deviation, and severe maxillary crowding before treatment. Radiographs reveal diphodontic gemination caused by union of supernumerary tooth and maxillary right central incisor, with no periapical radiolucency.

crown into mesial (one-third) and distal (two-thirds) segments. The tooth responded positively to both thermal and electrical stimuli and was caries-free, unrestored, and asymptomatic. All the other teeth were of normal size and shape.

Radiographic examination showed that the maxillary right central incisor had separate pulps and two different roots. No periapical radiolucency was observed. The diagnosis was diphodontic gemination, caused by union of the incisor and a supernumerary tooth.

Before the start of treatment, the patient and his parents were fully informed about the complex anatomy of the tooth, the therapeutic options, and possible complications. Although various approaches have been described for the treatment of fused teeth,^{13,19-24} the presence of two different roots, the absence of periapical lesions, and the patient's good periodontal and dental health made it possible to separate the supernumerary tooth from the normal incisor and extract it.^{23,24} After adequate time for healing, orthodontic treatment would be performed to close the space and level and align all the teeth.

Surgical Procedure

Several different surgical procedures have been proposed to remove a supernumerary element fused to a normal tooth.^{3,20,23-29} The most common is the one-step technique, in which a mucoperiosteal flap is raised and the supernumerary tooth is separated and removed. Because the flap repositioning creates a three-wall bone defect, this procedure often results in significant periodontal pocketing, chronic local gingival inflammation, and long epithelial attachments.²⁰

Another technique involves extraction of the double tooth, extraoral separation, and reimplantation. Possible complications are similar to those of the one-step technique, but with a greater risk of pulp necrosis, ankylosis, and external or internal tooth resorption.³

A third method involves a double surgical procedure designed to reduce periodontal problems. First, a 3mm buccal flap is raised to access the tooth, and the roots are separated along their entire length, without involving the epithelial junc-

tion. After six weeks, a second procedure is performed to separate the crowns and the remaining portion of the fused roots. After healing, 2-4mm periodontal pockets usually remain.^{25,26}

Yet another technique is guided tissue regeneration, which is also commonly used to avoid periodontal complications. After the supernumerary element is removed, a deproteinized bovine bone mineral (DBBM) graft is applied to the bone defect and covered with a resorbable collagen membrane, which prevents migration of the gingival epithelial cells and allows the periodontal cells to colonize the remaining root and create a new periodontal attachment.²⁹ This technique can be used in conjunction with any of the other procedures.

In our patient, we decided to use the one-step technique combined with guided tissue regeneration. Under local anesthesia, a full-thickness mucoperiosteal flap was raised from the maxillary right lateral incisor to the maxillary left central incisor. The crown of the supernumerary element was separated from that of the normal tooth under continuous irrigation, using a diamond disk (Fig. 2). About 3mm of bone was removed to expose the line of fusion of the roots, which were then separated using a high-speed thin-flame bur. Because



Fig. 2 Nonendodontic coronal resection of fused crowns for surgical removal of supernumerary element from normal incisor.

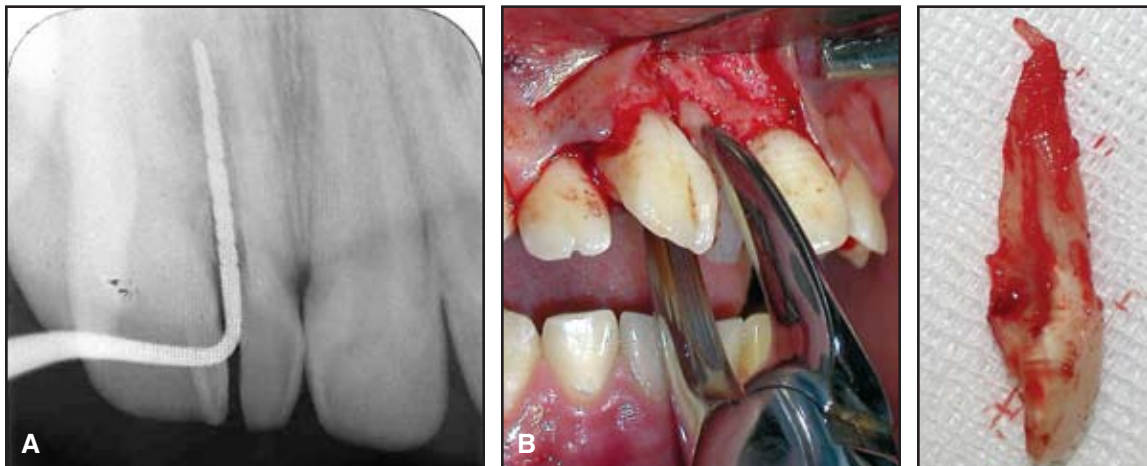


Fig. 3 A. Intraoperative radiograph showing separation of roots. B. Surgical luxation and extraction of supernumerary element.



Fig. 4 Postoperative radiograph six months after hemisection, showing no periapical pathology.

the complete separation of the fused roots required significant bone removal, an elevator was positioned between the roots to create a fracture. The supernumerary element was then luxated and removed (Fig. 3).

An 18mm-deep three-wall bone defect remained. The bone margins were refined with a manual bone file, and after deep irrigation of the bone defect with sterile saline solution, a periapical radiograph was obtained to check for tooth rem-

nants. The bone defect was then filled with DBBM (Bio-Oss*) and covered with a resorbable membrane²⁶ (Bio-Gide*) to improve periodontal and bone regeneration. Finally, the flap was repositioned and sutured. Manual compression was performed to control the bleeding and facilitate hemostasis. After a radiographic check, the patient was discharged with prescriptions for amoxicillin, 1g every 12 hours for five days, and chlorhexidine, .12% twice a day for two weeks, for oral disinfection. One week later, the suture was removed; good healing was observed, with minimal inflammation, and the patient reported no pain.

After a six-month follow-up period, healing had occurred with no complications, and the tooth had a normal response to thermal pulp testing. Periapical radiography showed good bone healing with normal marginal bone levels (Fig. 4).

Orthodontic Treatment

Four months after the surgical procedure, a full .022" × .028" appliance with Roth brackets was bonded in the mandibular arch, with bands on the first molars. The maxillary arch was not bonded for two additional months to allow continued healing in the upper incisor region. Leveling and alignment were carried out with a sequence of .014", .016", .018", .016" × .022", and .018" × .025" Sentalloy** wires. The remaining spaces in

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Fig. 5 After 26 months of orthodontic treatment, showing Class I molar and canine relationships and functional occlusion.

the maxillary arch were closed using a double-K-loop wire. An $.018" \times .025"$ stainless steel wire was placed in the lower arch, and Class II intermaxillary elastics were used to optimize the occlusion and intercuspation. Finally, an $.018" \times .025"$ stainless steel wire was inserted in the upper arch for torque control and arch coordination.

In the finishing phase, 2nd- and 3rd-order bends were used to give the maxillary right central incisor an appearance consistent with the rest of the teeth. The bands and brackets were removed after 26 months of orthodontic treatment (Fig. 5). Multistranded $.018"$ stainless steel lingual retainers were then bonded from canine to canine in the mandibular arch and from lateral incisor to lateral incisor in the maxillary arch, and the patient was instructed to wear a removable upper retainer at night. The patient was seen every two months to monitor the vitality of the maxillary right central incisor and the stability of the orthodontic results.

Restorative Treatment

Six months after debonding, the patient was satisfied with his functional and esthetic improvement, even though the appearance of the maxillary right incisor was still not optimal. He was informed



Fig. 6 Patient after conservative odontoplasty.

that a ceramic veneer bonded to the labial surface of the incisor would produce the best esthetic results. Given his young age, however, and with the consent of the patient and his parents, we decided to use more conservative measures for tooth restoration, leaving the veneer option for adulthood.

The labial surface of the tooth was remodeled with a diamond flame bur under constant irrigation. The overcontour of the mesial portion was also removed, and the surface was finished with stone burs (Fig. 6).

The total treatment time was 36 months. Three years after the end of treatment, no pulp pathology or color change of the maxillary right central incisor was evident, and radiographs showed no signs of root resorption (Fig. 7). The

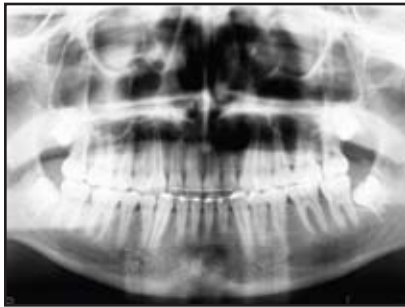


Fig. 7 Follow-up radiographs taken three years after end of treatment.

width of the attached gingiva was satisfactory, with pockets measuring 1.5-2mm; no loss of attachment was observed.

Discussion

Regardless of etiology, a double tooth is among the most challenging problems in dentistry.³⁰⁻³² Various treatment approaches have been recommended. One possibility involves extraction of the tooth, followed by approximation and conversion crowning of the adjacent teeth.¹⁹ Another option is selective grinding to reduce the width of the double tooth.²⁰ A third possibility is extraction and replacement with a removable partial denture until a fixed bridge or implant can be placed.¹³ A fourth option is surgical division of the double tooth.^{21,22} In certain circumstances, retention of fused or geminated teeth may be acceptable.¹³

Hemisection is recommended in cases involving esthetic or orthodontic problems if the fused tooth has two separate roots.²¹ If the pulp chambers are connected, endodontic treatment of the residual portion will be necessary, but this sometimes becomes evident only after the hemisection is performed.^{24,33}

The case shown here is similar to others reported by Karaçay and colleagues¹⁸ and Cetinbas and colleagues,³⁴ in which fused supernumerary teeth were extracted and the remaining teeth were orthodontically repositioned. Unlike other report-

ed cases,^{35,36} however, ours required no endodontic intervention, and there was no evidence of pulp-tissue necrosis three years later.

Treatment of patients with double teeth demands a multidisciplinary approach. To preserve the health of the remaining tooth, dental tissue must be removed only from the tooth being extracted; therefore, the line of fusion is not an appropriate surgical guide.³⁷ Contouring and polishing the surface of the remaining tooth are important to facilitate periodontal healing. Failure to use regenerative techniques can lead to periodontal complications and increase the risk of root resorption. Therefore, the use of a filler such as Bio-Oss is recommended to promote bone healing and prevent damage to the remaining root.^{26,29}

After bone and periodontal healing, there is no contraindication to orthodontic treatment.^{18,38,39} A double-tooth deformity is often associated with dental misalignment, malocclusion, and lack of arch symmetry. Moreover, the removal of the supernumerary element leaves a space that must be closed with careful attention to root alignment, since the crown of the remaining tooth will be remodeled at the end of treatment. This recontouring should not be performed until at least three months after surgery to avoid interference with bone healing of the traumatized tooth. In the meantime, any conservative cosmetic procedure may be used to improve the appearance of the tooth. Although prosthetic restoration can enhance

the treatment results, we believe it should be delayed until after the completion of growth.

REFERENCES

- de Siqueira, V.C.; Braga, T.L.; Martins, M.A.; Raitz, R.; and Martins, M.D.: Dental fusion and dens evaginatus in the permanent dentition: Literature review and clinical case report with conservative treatment, *J. Dent. Child.* (Chic.) 71:69-72, 2004.
- Scheiner, M.A. and Sampson, W.J.: Supernumerary teeth: A review of the literature and four case reports, *Austral. Dent. J.* 42:160-165, 1997.
- Rajab, L.D. and Hamdan, M.A.: Supernumerary teeth: Review of the literature and a survey of 152 cases, *Int. J. Paediatr. Dent.* 12:244-254, 2002.
- Onçag, O.; Candan, U.; and Arıkan, F.: Comprehensive therapy of a fusion between a mandibular lateral incisor and supernumerary tooth: Case report, *Int. Dent. J.* 55:213-216, 2005.
- Schuurs, A.H. and van Loveren, C.: Double teeth: Review of the literature, *A.S.D.C. J. Dent. Child.* 67:313-325, 2000.
- Schulze, C.: Developmental abnormalities of the teeth and the jaws, in *Thoma's Oral Pathology*, 6th ed., ed. R.J. Gorlin and H.M. Goldman, Mosby, St. Louis, 1970, pp. 96-183.
- Tannenbaum, K.A. and Alling, E.E.: Anomalous tooth development: Case reports of gemination and twinning, *Oral Surg. Oral Med. Oral Pathol.* 16:883-887, 1963.
- Pindborg, J.J.: *Pathology of the Dental Hard Tissues*, W.B. Saunders Co., Philadelphia, 1970, pp. 30-64.
- Neville, B.W.; Damm, D.D.; and White, D.K.: *Color Atlas of Clinical Oral Pathology*, 2nd ed., Lippincott Williams & Wilkins, Baltimore, 1999, pp. 58-66.
- Grammatopoulos, E.: Gemination or fusion? *Br. Dent. J.* 203:119-120, 2007.
- Chaudhry, S.I.; Sprawson, N.J.; Howe, L.; and Nairn, R.I.: Dental twinning, *Br. Dent. J.* 182:185-188, 1997.
- Méndez, P.; Junquera, L.; and Gallego, L.: Double teeth, *Br. Dent. J.* 202:508-509, 2007.
- Hashim, H.A.: Orthodontic treatment of fused and geminated central incisors: A case report, *J. Contemp. Dent. Pract.* 5:136-144, 2004.
- Ballal, N.V.; Kundabala, M.; and Acharya, S.: Esthetic management of fused carious teeth: A case report, *J. Esthet. Restor. Dent.* 18:13-17, 2006.
- Kremeier, K.; Pontius, O.; Klaiber, B.; and Hülsmann, M.: Nonsurgical endodontic management of a double tooth: A case report, *Int. Endod. J.* 40:908-915, 2007.
- Marshall, K.F. and Ellisdon, P.S.: Dental twinning, *Br. Dent. J.* 182:372, 1997.
- Tsurumachi, T. and Kuno, T.: Endodontic and orthodontic treatment of a cross-bite fused maxillary lateral incisor, *Int. Endod. J.* 36:135-142, 2003.
- Karaçay, S.; Gurton, U.; Olmez, H.; and Koymen, G.: Multidisciplinary treatment of "twinning" permanent teeth: Two case reports, *J. Dent. Child.* (Chic.) 71:80-86, 2004.
- Mills, J.R.E.: *Principles and Practice of Orthodontics*, Churchill Livingstone, New York, 1982, pp. 50-51.
- Brook, A.H. and Winter, G.B.: Double teeth: A retrospective study of "geminated" and "fused" teeth in children, *Br. Dent. J.* 129:123-130, 1970.
- İtkin, A.B. and Barr, G.S.: Comprehensive management of the double tooth: Report of case, *J. Am. Dent. Assoc.* 90:1269-1272, 1975.
- Moore, K.H.: A case report of bilateral double teeth, *Br. J. Orthod.* 11:40-41, 1984.
- David, H.T.; Krakowiak, P.A.; and Pirani, A.B.: Nonendodontic coronal resection of fused and geminated vital teeth: A new technique, *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 83:501-505, 1997.
- Indra, R.; Srinivasan, M.R.; Farzana, H.; and Karthikeyan, K.: Endodontic management of a fused maxillary lateral incisor with a supernumerary tooth: A case report, *J. Endod.* 32:1217-1219, 2006.
- Shapira, J.; Kochavi, D.; Harary, D.; and Chosack, A.: A two-step separation technique for fused teeth: Clinical report, *Pediatr. Dent.* 5:270-272, 1983.
- Kohavi, D. and Shapira, J.: Tissue regeneration principles applied to separation of fused teeth, *J. Clin. Periodontol.* 17:623-629, 1990.
- Kayalibay, H.; Uzamis, M.; and Akalin, A.: The treatment of a fusion between the maxillary central incisor and supernumerary tooth: Report of a case, *J. Clin. Pediatr. Dent.* 20:237-240, 1996.
- Aguiló, L.; Gandia, J.L.; Cibrian, R.; and Catala, M.: Primary double teeth: A retrospective clinical study of their morphological characteristics and associated anomalies, *Int. J. Paediatr. Dent.* 9:175-183, 1999.
- Olsen, C.B.; Johnston, T.; Desai, M.; and Peake, G.G.: Management of fused supernumerary teeth in children using guided tissue regeneration: Long-term follow up of 2 cases, *Pediatr. Dent.* 24:566-571, 2002.
- Guimarães Cabral, L.A.; Firoozmand, L.M.; and Dias Almeida, J.: Double teeth in primary dentition: Report of two clinical cases, *Med. Oral Patol. Oral Cir. Bucal.* 13:E77-80, 2008.
- Buenviaje, T.M. and Rapp, R.: Dental anomalies in children: A clinical and radiographic survey, *A.S.D.C. J. Dent. Child.* 51:42-46, 1984.
- Hamasha, A.A. and Al-Khateeb, T.: Prevalence of fused and geminated teeth in Jordanian adults, *Quintess. Int.* 35:556-559, 2004.
- Yücel, A.C. and Güler, E.: Nonsurgical endodontic retreatment of geminated teeth: A case report, *J. Endod.* 32:1214-1216, 2006.
- Cetinbas, T.; Halil, S.; Akcam, M.O.; Sari, S.; and Cetiner, S.: Hemisection of a fused tooth, *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 104:e120-124, 2007.
- Velasco, L.F.; de Araujo, F.B.; Ferreira, E.S.; and Velasco, L.E.: Esthetic and functional treatment of a fused permanent tooth: A case report, *Quintess. Int.* 28:677-680, 1997.
- Atasu, M. and Cimilli, H.: Fusion of the permanent maxillary right incisor to a supernumerary tooth in association with a gemination of permanent maxillary left central incisor: A dental, genetic and dermatoglyphic study, *J. Clin. Pediatr. Dent.* 24:329-323, 2000.
- Hong, H.H.; Tsai, A.I.; Liang, C.H.; Kuo, S.B.; Chen, C.C.; Tsai, T.P.; and Lu, C.F.: Preserving pulpal health of a geminated maxillary lateral incisor through multidisciplinary care, *Int. Endod. J.* 39:730-737, 2006.
- Foster, T.D.: Fusion and duplication: Orthodontic treatment of a developmental anomaly, *Eur. J. Orthod.* 9:240-242, 1987.
- Danesh, G.; Schrijnemakers, T.; Lippold, C.; and Schäfer, E.: A fused maxillary central incisor with dens evaginatus as a talon cusp, *Angle Orthod.* 77:176-180, 2007.