

Endodontic and Esthetic Management of Maxillary Lateral Incisor Fused to a Supernumerary Tooth Associated with a Talon Cusp by Using Spiral Computed Tomography as a Diagnostic Aid: A Case Report

Kavita Rani A, MDS,* Sandeep Metgud, MDS,* Shoeb Sheikh Yakub, MDS,* Umesh Pai, MDS,[†] N.G. Toshniwal, MDS,[‡] and Naval Bawaskar, MDS[‡]

Abstract

The aim of this case report is to present an endodontically and esthetically managed maxillary left lateral incisor fused to a supernumerary tooth associated with a talon cusp. This case report describes a multidisciplinary approach involving endodontic and restorative considerations for a successful, functional, and esthetic rehabilitation of the fused tooth. In the present case, we have used spiral computed tomography for better understanding of the complicated root canal morphology of the fused tooth and successful management of this rare case. (*J Endod* 2010;36:345–349)

Key Words

Fusion, spiral computed tomography, supernumerary, talon's cusp

From the *Department of Conservative Dentistry and Endodontics, [†]Department of Prosthodontics, and [‡]Department of Orthodontics and Dentofacial Orthopedics, Rural Dental College, Pravara Institute of Medical Sciences, Loni BK, Maharashtra, India.

Address requests for reprints to Dr Kavita Rani A, Senior Lecturer, Dept of Conservative Dentistry and Endodontics, Rural Dental College, Pravara Institute of Medical Sciences, Loni BK, PinCode No- 413736, Rahata, AhmedNagar, Maharashtra, India. E-mail address: kavitarudagi_11@rediffmail.com. 0099-2399/\$0 - see front matter

Copyright © 2010 American Association of Endodontists. doi:10.1016/j.joen.2009.07.014

Morphoanatomic changes in teeth might be divided according to the site of their occurrence, ie, tooth crown, roots, and root canals. Fusion and gemination are irregularities in tooth development (1). Pindborg (2) defined fusion as the union between dentin and/or enamel of 2 or more separate developing teeth. Fusion, an uncommon anomaly of the hard dental tissues, might cause clinical problems related to appearance, spacing, and periodontal conditions. The incidence of fusion is <1% in the white population (3). Clinically, it is often difficult to differentiate between fusion and germination, and it is common to refer to these anomalies as “double teeth” (4, 5).

Pindborg (2) described gemination as the malformation of a single tooth bud, resulting in an anomalous tooth within the normal complement of teeth. It is recognized as an attempt by a single tooth germ to divide, with a resultant large single tooth with a bifid crown and usually a common root and root canal.

The degree of fusion depends on the stage of tooth development that has occurred at the time of fusion, with the union of dentin being the main criterion. Fused teeth might contain separate pulp canals or share a common pulp canal. Fusion might occur between 2 normal teeth or between a normal tooth and a supernumerary tooth. In the latter case, differentiation from gemination might be difficult, if not impossible (6).

A malformation of a tooth characterized by the presence of an anomalous structure resembling an eagle's talon, projecting lingually from the cingulum areas of a maxillary or a mandibular permanent incisor, is called talon cusp or dens evaginatus (6). On literature review, there are several reports concerning dens evaginatus (7–10) and dental fusion (11–18); concurrence of dens evaginatus and dental fusion in the same tooth is a rarity (19, 20).

Clearly, a careful clinical and radiographic examination is beneficial for optimal treatment planning. Conventional intraoral periapical radiographs are an important diagnostic tool in endodontics for assessing the root canal configuration. However, the normal dental radiographs usually are not sufficient to aid in understanding the complicated morphology of the root canal system, as in the case of fused teeth. These problems might be overcome by using newer diagnostic methods such as spiral computed tomography (SCT) or volume acquisition CT, which can produce 3-dimensional (3D) images of individual teeth and the surrounding tissues.

This case report presents the endodontic and esthetic management of a fused maxillary lateral incisor with a supernumerary tooth along with talon cusp with the use of SCT as a diagnostic aid.

Case Report

A 22-year-old male patient presented to the Department of Conservative Dentistry and Endodontics with pain to hot and cold food in the left maxillary anterior region. On clinical examination, the maxillary left lateral incisor exhibited abnormal crown morphology. The tooth was wider mesiodistally and had a talon cusp on the lingual side (Fig. 1A, B). Caries in the developmental groove on the distal side of the talon's cusp was evident.

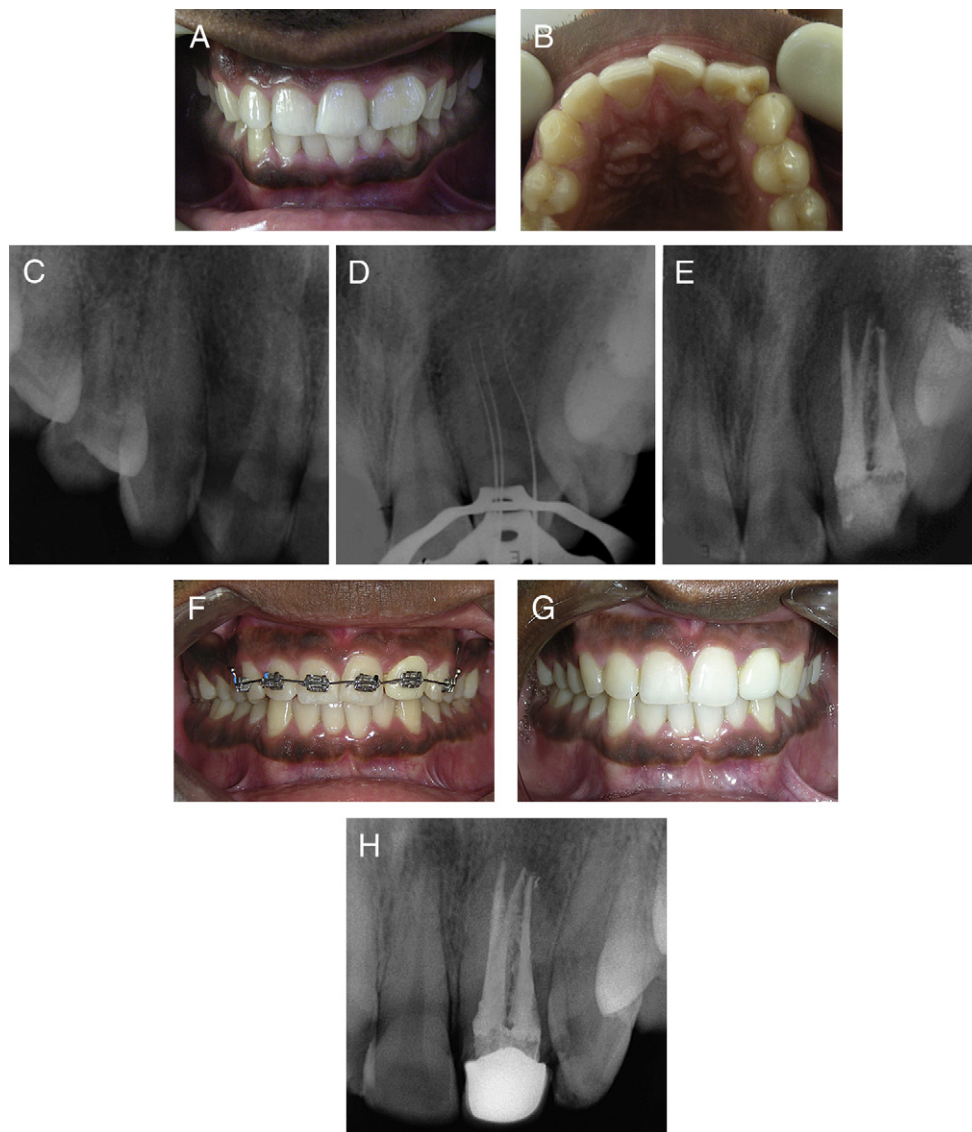


Figure 1. (A) Preoperative photograph: labial view. (B) Preoperative photograph: occlusal view showing the talon cusp and mild anterior crowding with maxillary anterior teeth. (C) Preoperative radiograph revealing irregular morphology of tooth #10. (D) Working length determination. (E) Postoperative final radiograph. (F) Sectional orthodontic appliance during treatment. (G) Permanent esthetic rehabilitation of tooth #10. (H) Recall radiograph 1 year postoperatively.

There was no history of trauma or any hereditary conditions. Medical history was noncontributory. All vital signs were found to be within normal limits. Oral examination revealed mild crowding with the maxillary anteriors and a normal set of dentition. The tooth was not sensitive to palpation or percussion. The tooth responded to an electric pulp tester (Parkell Electronics, Farmingdale, NY) and showed early response to the cold test (RC Ice; Prime Dental Products, Mumbai, India). On radiographic examination, the exact anatomy of the tooth could not be clearly identified, but it was possible to recognize the complex structure of the pulp (Fig. 1C). Therefore, to ascertain the complex root canal anatomy of the tooth in a 3D manner, dental imaging with the help of SCT was therefore planned. Informed consent from the patient was obtained, and a multislice SCT of the maxilla was performed by using the dental software Dentascan (GE Healthcare, Milwaukee, WI). A 3D image of the maxilla was obtained. The involved tooth was focused, and the morphology was obtained in transverse, axial, and sagittal sections of 0.5-mm thickness (Fig. 2), along with 3D reconstructed images (Fig. 2). The images revealed that the left maxillary

lateral incisor had a single large pulp chamber with 2 root canals (a type IV mesial canal according to Wiene's classification and a distal canal). On the basis of clinical, radiographic, and SCT findings, a diagnosis of irreversible pulpitis with the fused maxillary left lateral incisor and supernumerary tooth along with talon cusp was made.

Management

Local anesthesia was administered, and a rubber dam was applied. Endodontic access cavity was done on the palatal surface by using a no. 2 round bur and EX 24 bur (non end cutting tapered fissure; Mani, Tochigi, Japan). Pulp extirpation was performed by using a barbed broach (Dentsply Maillefer, Ballaigues, Switzerland) and K-files (Mani Inc, Tochigi, Japan). The canal was thoroughly debrided with copious irrigation of sodium hypochlorite (2.5%), followed by saline (0.9%). Coronal flaring of the root canal was done by using Gates-Glidden drills no. 1 to 4 (Mani Inc). The working length was determined by using apex locator (Propex; Dentsply Maillefer) and confirmed radiographically

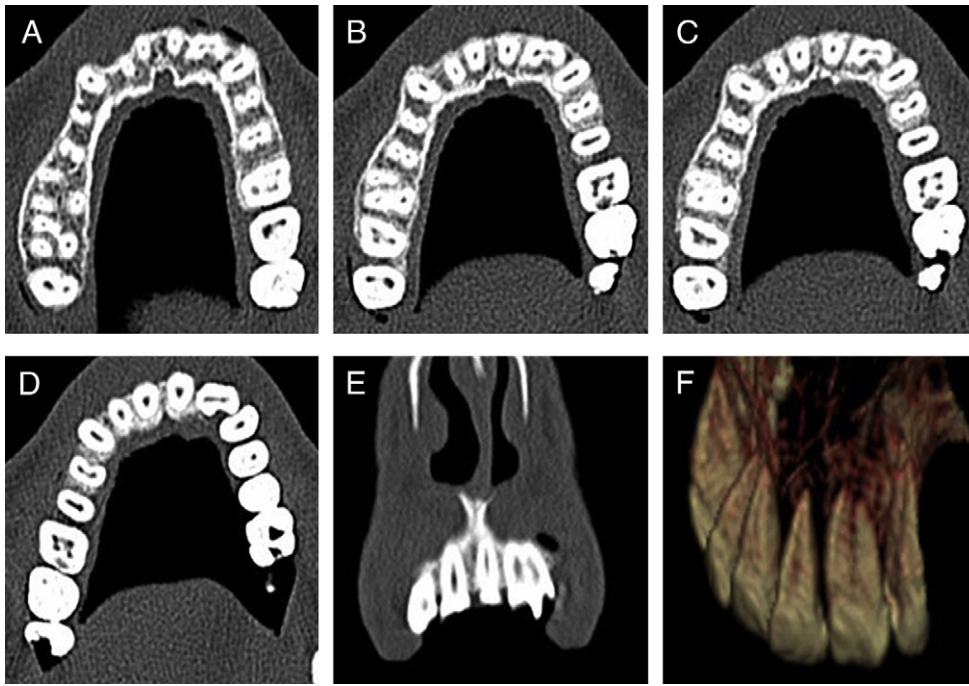


Figure 2. SCT images of the maxilla. (A) Axial view of the apical third section of the roots of the maxillary left lateral incisor. (B) Axial view of the middle third section of the roots of the maxillary left lateral incisor. (C) Axial view of the cervical third section of the roots of the maxillary left lateral incisor. (D) Axial view of the coronal third section of the crown of the maxillary left lateral incisor. (E) Coronal view of the left maxillary lateral incisor. (F) 3D reconstruction of the fused tooth.

(Fig. 1D). Cleaning and shaping of the root canal system were completed by using a step-back technique (apical enlargement was done up to ISO no. 40). Canals were copiously irrigated with sodium hypochlorite (2.5%), followed by saline. The canal was dried with sterile paper points, calcium hydroxide (Ultralac XS; Ultradent, South Jordan, UT) was placed in the root canal, and the access cavity was temporized with Cavit G (3 M ESPE, Seefeld, Germany). The patient was recalled after 1 week for obturation.

After a week, the tooth was asymptomatic, and the root canal was obturated by using thermoplastic obturation technique (E&Q plus; Meta Biomed Co Ltd, Cheongju, Korea) and AH PLUS as a sealer. The access cavity was then sealed with resin composite (Fig. 1E).

After the endodontic treatment was completed, the esthetic management was discussed with the patient. The available treatment options included (1) orthodontic alignment and leveling followed by prosthodontic rehabilitation of the fused tooth and (2) prosthodontic rehabilitation with the left maxillary central incisor, fused tooth, and the canine to improve the esthetics. The patient opted for the orthodontic alignment because it was a more conservative approach. The fused tooth was prepared to receive porcelain crown, and a temporary crown with decreased mesiodistal dimensions was cemented. Around 1.5 mm space was created on the mesial side of the fused tooth to align and accommodate the central incisor. A Roth 0.018 inch preadjusted edgewise appliance with sectional mechanics was opted. Direct bonding was performed from canine to canine (Fig. 1F). Treatment duration was for 5 months. A retention protocol included an Essix retainer (from canine to canine) after permanent porcelain crown cementation with the fused tooth and direct composite veneering with the canine to close the residual space (Fig. 1G). Retention was continued for a period of 6 months, with a periodic evaluation every month. The tooth was totally asymptomatic at 1-year recall visit (Fig. 1H).

Discussion

A malformed tooth often is a challenge to the dentist. Fused teeth afford a striking clinical manifestation of the differentiable and morphogenetic processes of tooth development. Clinically, it might be difficult to differentiate between fusion and gemination when a supernumerary tooth is fused with a permanent tooth. Fusion between supernumerary and permanent teeth occurs less frequently than fusion between other types of teeth. The incidence of unilateral occurrence is estimated in the literature to be 0.5% in the deciduous and 0.1% in the permanent dentition. The incidence of bilateral occurrence is estimated at around 0.02% for both types of dentition (1, 21, 22). As far as the etiology for fusion is concerned, many theories have been proposed, including genetic factors, local metabolic interference during tooth bud differentiation, traumatic or inflammatory causes (1, 6, 23). To explain fusion, some authors suggest a lack of space as the cause of deep penetration of the dental follicles (1).

Generally, fused teeth are asymptomatic and do not require treatment, and if esthetically acceptable, the patient might even decide to retain the anomalous tooth (16). However, double teeth can cause esthetic and functional problems, carious lesions in the grooves, particularly in the fusion zone; periodontal problems associated with the grooves that extend subgingivally; asymmetries when fusion occurs in the anterior segment; malocclusions, especially when supernumeraries are involved (23), and endodontic complications, which are frequent because of the reduced thickness of enamel and dentin (24). The morphology of fused teeth varies, and complex forms with separated or fused coronal pulp chambers are present. Even separated chambers can meet in the radicular area or can remain separated.

Radiographic examination is an essential component of the management of endodontic problems. It underpins all aspects of

endodontic treatment from diagnosis and treatment planning to assessing outcome. The amount of information gained from conventional film and digitally captured periapical radiographs is limited by the fact that the 3D anatomy of the area being radiographed is compressed into a 2-dimensional image. As a result of superimposition, periapical radiographs reveal limited aspects of the 3D anatomy. In addition, there might also be geometric distortion of the anatomic structures being imaged (25). These problems can be addressed by the use of SCT, which can produce 3D images of individual teeth and aid in better understanding of the root canal morphology.

A new CT technique, SCT or volume acquisition CT, has been developed that has an inherent advantage. Current CT scanners have a linear array of multiple detectors, allowing multiple slices to be taken simultaneously, resulting in faster scan times and often less radiation exposure to the patient. The slices of data are then "stacked" up and can be reformatted to obtain 3D images (26).

SCT can get a large volume of data in seconds and offers more rapid examination time, with an effective dose in the range of about 1–30 mSv, which is much less than the conventional CT (27). Christoph et al (28) have proposed an SCT protocol with a reduced radiation dose (0.56 ± 0.06 mGy) down to the level of a single panoramic radiograph. However, keeping in mind the extra cost associated, its use should be limited to cases with unusual tooth morphology.

In this specific case, an SCT could confirm the complicated morphology of the root canal system of the fused tooth. This technique seems to have the potential to visualize the topography of root canals and offer new perspectives for dental imaging of special clinical cases. SCT has been used successfully in clinical dentistry for the confirmatory diagnosis of morphologic aberrations in the root canal anatomy (29–33), and it might provide a better, more accurate, and faster diagnostic method in 3 dimensions.

Talon cusp, or dens evaginatus of anterior teeth, is a relatively rare odontogenic anomaly arising during the morphodifferentiation phase of tooth development. Talon cusp might represent the extreme of a continuous variation progressing from a normal cingulum through an enlarged cingulum (trace talon) and a small accessory cusp (semi talon) to a talon cusp (8, 10, 34). Developmental dental abnormalities reported to be associated with talon cusp include peg-shaped lateral incisor, dens evaginatus of posterior teeth, odontoma, megadont, supernumerary tooth, shovel-shaped incisors, dens invaginatus, congenitally missing tooth, and exaggerated Carabelli cusp (6, 8, 10, 35). However, the occurrence of talon cusp with fusion is a relatively rare phenomenon. The treatment of talon cusp involves careful clinical judgment and is dependent on whether the cusp contains or is devoid of a pulp horn. Mellor and Ripa (35) stated that removal of the cusp will inevitably lead to pulp exposure that requires root canal treatment. In the present case, the tooth was already endodontically involved, and hence no special emphasis was placed on the treatment of the talon cusp.

Related to the "two-tooth rule" of Mader (36), the anomaly presented in this case might represent a fusion between a normal tooth and a supernumerary tooth. Because no missing permanent tooth was seen in this patient, it can be presumed that a fusion with a supernumerary tooth occurred. On the basis of the analysis of radiographic and SCT findings of the present case and the clinical appearance of the tooth, the diagnosis of fusion between a supernumerary tooth and maxillary left lateral permanent incisor along with talon cusp was made.

The treatment of fused teeth can be complex and contain various treatment protocols that might include a multidisciplinary approach as a result of the abnormal crown shape, size and root formation, and esthetic problems in addition to endodontic considerations. In this

case, crowding with the maxillary anterior region was corrected orthodontically, and the fused tooth was esthetically restored with a ceramic crown. The endodontic and esthetic problem was therefore resolved by using a multidisciplinary approach and SCT as a valuable diagnostic tool.

Conclusion

With the advent of newer tomographic scanners like cone beam computed tomography (CBCT) or digital volume tomography specifically for maxillofacial and dental use, conventional scanners like SCT will be less preferred for dental imaging purposes. CBCT is advantageous in that it has a low effective dose in the same order of magnitude as conventional dental radiographs (37). Nevertheless, the value of SCT as a diagnostic tool cannot be undermined. This case discussed above uses SCT as a diagnostic tool to a great effect in understanding the complex root canal anatomy, thus helping a great deal in rendering successful endodontic therapy.

This case report demonstrates a predictable and successful solution toward the endodontic and esthetic management of a fused maxillary lateral incisor with a supernumerary tooth, adopting a multidisciplinary approach in the most conservative way.

References

1. Duncan WK, Helpin ML. Bilateral fusion and gemination: a literature analysis and case report. *Oral Surg Oral Med Oral Pathology* 1987;64:82–7.
2. Pindborg JJ. *Pathology of the dental hard tissues*. Philadelphia: W.B. Saunders; 1970.
3. Bueviaje TM, Rapp R. Dental anomalies in children: a clinical and radiographic survey. *J Dent Child* 1984;51:42–6.
4. Brook AH, Winter GB. Double teeth: a retrospective study of 'geminated' and 'fused' teeth in children. *Br Dent J* 1970;129:123–30.
5. Yuen SW, Chan JC, Wei SH. Double primary teeth and their relationship with the permanent successors: a radiographic study of 376 cases. *Pediatric Dentistry* 1987;9:42–8.
6. Shafer WG, Hine MK, Levy BM. *A textbook of oral pathology*. 4th ed. 2001:41–5.
7. Hülsmann M. Aetiology and therapy of dens evaginatus. *Endodontie* 2004;13:363–72.
8. Hattab FN, Yassin OM, al-Nimri KS. Talon cusp: clinical significance and management—case reports. *Quintessence Int* 1995;26:115–20.
9. Richardson DS, Knudson KG. Talon cusp: a preventive approach to treatment. *J Am Dent Assoc* 1985;110:60–2.
10. Davis PJ, Brook AH. The presentation of talon cusp: diagnosis clinical features, associations and possible aetiology. *Br Dent J* 1985;160:84–8.
11. Surtont PA, Martens LC, De Craene LG. A complete fusion in the primary human dentition: a histological approach. *J Dent Child* 1988;55:362–7.
12. Blaney TD, Hartwell GR, Bellizzi R. Endodontic management of a fused tooth: a case report. *J Endod* 1982;8:227–30.
13. Kim E, Yi-Tai Jou. A supernumerary tooth fused to the facial surface of a maxillary permanent central incisor: case report. *J Endod* 2000;26:45–8.
14. Sivolletta S, Bressan E, Mirabal V, Stellini E, Berengo M. Extraoral endodontic treatment, odontotomy and intentional replantation of a double maxillary lateral permanent incisor: case report and 6-year follow-up. *International Endodontic Journal* 2008;41:538–46.
15. Kremeier K, Pontius O, Klaiber B, Hülsmann M. Nonsurgical endodontic management of a double tooth: a case report. *International Endodontic Journal* 2007;40:908–15.
16. Hashim HA. Orthodontic treatment of fused and geminated central incisors: a case report. *J Contemp Dent Pract* 2004;15:136–44.
17. Pereira AJA, Fidel RAS, Fidel SR. Maxillary lateral incisor with two root canals: fusion, gemination or dens invaginatus. *Braz Dent J* 2000;11:141–6.
18. Ballal VN, Kundabala M, Acharya S. Esthetic management of fused carious teeth: a case report. *J Esthet Restor Dent* 2006;18:13–8.
19. de Siqueira VC, Braga TL, Martins MA, Raitz R, Martins MD. Dental fusion and dens evaginatus in the permanent dentition: literature review and clinical case report with conservative treatment. *J Dent Child (Chic)* 2004;1:69–72.
20. Danesh G, Schrijnemakers T, Lippold C, Schäfer E. A fused maxillary central incisor with dens evaginatus as a talon cusp. *Angle Orthod* 2007;77:176–80.
21. Tasa GL, Lukacs JR. The prevalence and expression of primary double teeth in western India. *ASDC Journal of Dentistry for Children* 2001;68:196–200.

22. Tomizawa M, Shimizu A, Hayashi S, Noda T. Bilateral maxillary fused primary incisors accompanied by succedaneous supernumerary teeth: report of a case. *International Journal of Paediatric Dentistry* 2002;2:223–7.
23. Hulsmann M, Bahr R, Grohmann U. Hemisection and vital treatment of a fused tooth: literature review and case report. *Endodontics and Dental Traumatology* 1997;13:253–8.
24. Tsesis I, Steinbock N, Rosenberg E, Kaufman AY. (2003) Endodontic treatment of developmental anomalies in posterior teeth: treatment of geminated/fused teeth – report of two cases. *International Endodontic Journal* 2003;36:372–9.
25. Grondahl H-G, Huumonen S. Radiographic manifestations of periapical inflammatory lesions. *Endodontic Topics* 2004;8:55–67.
26. Hu H, He HD, Foley WD, Fox SH. Four multidetector-row helical CT: image quality and volume coverage speed. *Radiology* 2000;215:55–62.
27. Zoetelief J, Geleijns J. Patient doses in spiral CT. *Br J Radiol* 1998;7:584–6.
28. Christoph GD, Wilfried GH, Engel Britta R, Hermann KP, Oestmann JW. Must radiation dose for ct of the maxilla and mandible be higher than that for conventional panoramic radiography? *Am Soc Neuroradiol* 1996;96:1758–60.
29. Ballal S, Sachdeva GS, Kandaswamy D. Endodontic management of a fused mandibular second molar and paramolar with the aid of spiral computed tomography: a case report. *J Endod* 2007;33:1247–51.
30. Robinson S, Czerny C, Gahleitner A, Bernhart T, Kainberger FM. Dental CT evaluation of mandibular first premolar root configurations and canal variations. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002;93:328–32.
31. Sponchiado EC Jr., Ismail HA, Braga MR, de Carvalho FK, Simoes CA. Maxillary central incisor with two root canals: a case report. *J Endod* 2006;32:1002–4.
32. Gopikrishna V, Bhargavi N, Kandaswamy D. Endodontic management of a maxillary first molar with a single root and a single canal diagnosed with the aid of spiral CT: a case report. *J Endod* 2006;32:687–91.
33. Gopikrishna V, Rueben J, Kandaswamy D. Endodontic management of a maxillary first molar with two palatal roots and a single fused buccal root diagnosed with spiral computed tomography: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;105:e74–8.
34. Hattab FN, Yassin OM, Al-Nimri KS. Talon cusp in permanent dentition associated with other dental anomalies: review of literature and report of seven cases. *Journal of Dentistry for Children* 1996;63:368–76.
35. Mellor JK, Ripa LW. Talon cusp: a clinically significant anomaly. *Oral Surg Oral Med Oral Pathol* 1970;29:225–8.
36. Mader CL. Fusion of teeth. *J Am Dent Assoc* 1979;98:62–4.
37. Patel S, Dawood A, Pitt Ford T, Whites E. The potential applications of cone beam computed tomography in the management of endodontic problems. *International Endodontic Journal* 2007;40:818–30.