



# Management of fused supernumerary teeth in children using guided tissue regeneration: long-term follow up of 2 cases

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## Abstract

Surgical separation of supernumerary teeth fused to permanent incisor teeth has typically given rise to residual post surgical periodontal defects, including loss of attachment and deep periodontal pocketing with persistent inflammation. Other complications include devitalisation of the retained tooth section, ankylosis, external and replacement resorption. A unique technique of using guided tissue regeneration has been successfully employed to promote periodontal healing, after 2 cases of surgical removal of a supernumerary tooth fused to a permanent maxillary lateral incisor tooth. In the first case, a 2-stage guided tissue regeneration technique was completed with a nonresorbable Gor-Tex membrane, and was followed up after 9 years. The second case was completed using a resorbable Vicryl membrane, in a single-stage guided tissue regenerative technique; and was followed up after 5 years. (*Pediatr Dent.* 2002; 24:566-571)

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Supernumerary teeth are defined as an excess number of teeth when compared with the normal dental formula.<sup>1,2</sup> Supernumerary teeth occur with a frequency of 1%-4% in the permanent dentition, where 90%-98% of supernumerary teeth are found in the maxilla, mainly in the incisor region.<sup>1-3</sup> Described morphological types of supernumerary teeth include conical, tuberculate, supplemental, and odontome.<sup>2</sup> It is rare for a surplus number to be compensated by an absence of other teeth, so supernumerary teeth typically cause disturbances to the normal eruption and position of adjacent teeth. Management of supernumerary teeth depends on morphology, position, and the effect or potential effect on adjacent teeth, and should form part of a comprehensive treatment plan.<sup>1-3</sup>

Fusion is defined as the union of 2 individual tooth buds in close approximation, and may involve enamel, dentin, pulp, and cementum.<sup>3,4</sup> Fusion may involve root cementum only or also root and crown dentin and enamel. Root canals may be separate or conjoined. Rarely supernumerary

teeth may be fused to normal teeth in the arch, usually by medial or lateral fusion.<sup>3-5</sup> Difficulties associated with this type of fusion include poor esthetics, abnormal eruption, crowding, poor occlusal interdigitation, problems managing the tooth to which the supernumerary tooth is fused, and residual post surgical periodontal defects.<sup>2,3,6</sup>

Four surgical techniques for removal of fused supernumerary teeth have been described. The most commonly reported technique has been a 1-stage procedure where a labial mucoperiosteal flap is raised followed by separation of the 2 teeth along the fusion line.<sup>4,5,7</sup> The supernumerary root is extracted, leaving a 3-walled bony defect following flap repositioning. Following most surgical separative procedures, deep periodontal pockets between 4 to 9 mm with persistent inflammation or a long junctional epithelial attachment are usual.<sup>4,5</sup> Apart from increased periodontal pocket depth, other complications may include devitalisation of the retained tooth section, ankylosis, external and replacement resorption, difficulty in restoration of

the exposed dentin face on the remaining crown, and development of dental caries in the line of fusion.<sup>4,8-10</sup> A second approach has been to surgically extract both the supernumerary fused to the tooth complex then extraorally section the supernumerary portion, and finally, replant the tooth to be preserved.<sup>9</sup> Complications of this technique include devitalisation and progressive external resorption of the replanted tooth as well as deep periodontal pocket formation.<sup>9</sup> A third method to overcome periodontal pocket formation or external resorption uses a 2-stage surgical technique.<sup>8</sup> Initially, access is gained via a semilunar incision made on the labial aspect 3 mm below the periodontal margin, and a mucoperiosteal flap is reflected apically. The 2 roots are surgically divided apically along their entire length, from a point near the junctional epithelium, but without involving it. Healing is allowed to take place for 6 weeks, followed by a second procedure to divide the crowns and the remaining coronal portion of the roots. Final healing occurs with reported pocket depths of 2 to 3 mm.<sup>8</sup> With the aim of minimizing residual periodontal pocket formation, a fourth technique using guided tissue regeneration has been developed to promote periodontal healing following surgical removal of the supernumerary tooth.<sup>6</sup>

Guided tissue regeneration assumes that different cell types have different migration rates during wound healing.<sup>11</sup> Following removal of the supernumerary portion, adequate new attachment can only occur if gingival tissues are excluded from the exposed root face.<sup>6</sup> An inert membrane placed over the surgically created periodontal defect prevents apical migration of gingival epithelium and connective tissue into the defect while allowing the periodontal ligament cells of the remaining tooth to repopulate the root surface and form a new attachment.<sup>12</sup>

### Case report 1

An 11-year, 9-month Caucasian female was referred to the Children's Unit of the Royal Dental Hospital of Melbourne by the School Dental Service for management of a supernumerary tooth fused to the maxillary left permanent lateral incisor tooth. The patient had no significant medical history. Extraoral examination showed a mesofacial and orthognathic skeletal pattern. Dental examination revealed a late mixed dentition in molar Class I occlusion, with minimal lower anterior crowding. No dental caries was present, and oral hygiene was fair.

The maxillary left permanent lateral incisor tooth was distopalatally rotated 30° and fused to a distal supernumerary tooth (Fig 1). Radiographic examination revealed the teeth fused along the entire length, with each tooth having separate pulp canals, and no radiographic evidence of communication (Fig 2). Periodontal probing depths were 2 to 3 mm around the maxillary left permanent lateral incisor tooth-supernumerary complex. Both sections of the teeth were positive to pulp testing. It was decided to attempt removal of the supernumerary portion using a guided tissue regenerative technique to avoid adverse periodontal sequelae.



Fig 1. Case 1—maxillary left permanent lateral incisor tooth fused to supernumerary tooth at presentation

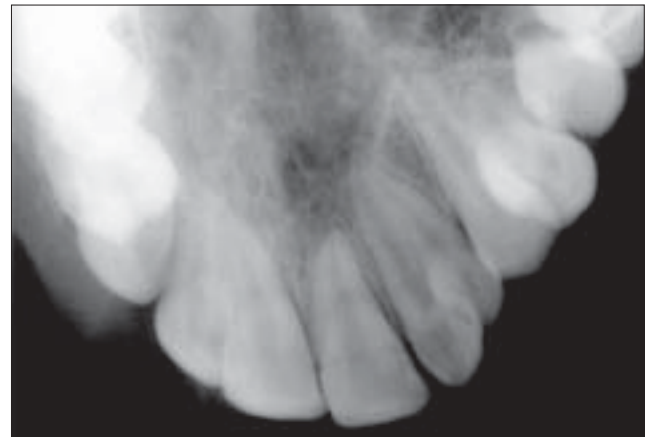


Fig 2. Case 1—periapical radiograph of maxillary left permanent lateral incisor tooth fused to supernumerary tooth

Surgical removal of fused supernumerary teeth using this technique had not been described in the literature at this time (March 1992). The 2-stage separation technique as described by Kohavi was rejected due to the length of the fusion and the necessity of a clear surgical field for complete visualization of the apical section.<sup>8</sup>

After discussion with the patient and her family concerning alternative treatment modalities, including extraction and prosthetic replacement, the known complications of tooth division, and the unknown prognosis of the proposed tissue regenerative treatment, it was decided to remove the supernumerary tooth under local anesthesia using this technique.

The surgical procedure was performed using buccal and palatal infiltrations of Xylocaine (Astra Pharmaceuticals Pty Ltd, North Ryde, Australia) with 1:80000 adrenaline local anesthesia. Buccal and palatal full thickness mucoperiosteal flaps were raised, extending from the maxillary left permanent central incisor tooth to the maxillary left first premolar tooth, with a buccal vertical relieving incision at the maxillary left first premolar tooth. A longitudinal groove was seen supracrestally on the root surface of the maxillary left permanent lateral incisor tooth at the assumed site of fusion. Bone was removed with a tapered fissure surgical bur using saline irrigation, following the groove to 3 mm from the root



Fig 3. Case 1—nonresorbable Gor-Tex membrane in situ after surgical removal of supernumerary portion



Fig 4. Case 1—sectional orthodontic arch used to retract maxillary left permanent canine tooth away from healing wound site

apex. Further bone removal was avoided to prevent possible trauma to the periapical neurovascular bundle and to keep the surgical site within the extensions of the Gore-Tex (WL Gore & Associates, Flagstaff, Ariz) periodontal membrane chosen. The tooth was then divided with a high-speed, fine-tapered diamond bur using copious irrigation. An elevator was used to fracture the apical 3 mm, and the distal root segment was extracted leaving a 15-mm bony defect.

A Gore-Tex periodontal membrane was placed over the defect, trimmed distally to fit around the erupting maxillary left permanent canine, and secured in place with Gore-Tex sutures (Fig 3). Using multiple silk sutures, submucosal relieving incisions were placed in the 2 flaps to allow complete wound closure. Doxycycline (200 mg stat, 100 mg daily for 6 days), Ibuprofen (100 mg tid for 6 days), and Chlorhexidine mouthrinse (0.2% aq tid) were prescribed.

Postoperative review and suture removal at 1 week showed the surgical site was healing with minimal signs of inflammation. Oral hygiene was excellent and the area was asymptomatic. However, a soft tissue defect had developed over the extraction site, exposing the Gore-Tex periodontal membrane. The membrane was sitting 7 mm apically to the cemento-enamel junction, and it was considered that a favorable prognosis of the periodontal treatment was doubtful.

Review at 4 weeks postoperatively revealed a layer of granulation tissue covering the superficial surface of the membrane. The mesially erupting maxillary left permanent canine tooth was lifting the membrane incisally and dislodging the cuff from around the maxillary left permanent lateral incisor tooth. The membrane was removed under local anesthesia 6 weeks postoperatively, exposing the maxillary left permanent canine tooth at the same time. The wound was closed with multiple silk sutures. Chlorhexidine mouthrinse and Panadeine (Smith Kline Beecham (Australia) Pty Ltd, Ermington, Australia) analgesics were prescribed. The sutures were removed 7 days later. A periapical radiograph indicated bone regeneration in the extraction site and a developing periodontal ligament.

Two months following the surgery, the crown of the maxillary left permanent canine tooth was contacting the distal portion of the maxillary left permanent lateral incisor

tooth with mild gingivitis interproximally, associated with a fall in oral hygiene status. The papilla distal to the maxillary left permanent lateral incisor tooth had receded with a negative architecture. A concern was held that the lack of papilla may leave an esthetic defect following complete eruption of the maxillary left permanent canine tooth. The maxillary left permanent lateral incisor had 3 mm loss of attachment and a 4 mm periodontal pocket distally. The maxillary left permanent lateral incisor tooth remained positive to pulp testing.

Three months following the procedure, oral hygiene was poor and mild gingivitis was present in the surgical area. The maxillary left permanent canine tooth had erupted into approximation with the maxillary left permanent lateral incisor tooth. A sectional fixed orthodontic appliance was placed from the maxillary left permanent canine tooth to the maxillary left permanent first molar tooth to retract the maxillary left permanent canine tooth away from the healing wound site (Fig 4). No attempt was made to rotate the maxillary left permanent lateral incisor tooth. Complete movement was achieved in 4 weeks and was retained for a further 4 weeks. Following the retention phase, the crown of the maxillary left lateral incisor tooth was modified using composite resin, thereby closing the interproximal space adjacent to the maxillary left permanent canine tooth. A periapical radiograph taken 3 months following surgery revealed a periodontal ligament space at the extraction site. Periodontal probing depths in the extraction area were 2 to 3 mm, with 3 mm loss of attachment (Fig 5).

A split mucosal graft to augment the papillary architecture distal to the maxillary left permanent lateral incisor tooth was considered, but was deferred indefinitely due to poor oral hygiene and lack of patient enthusiasm. The patient subsequently received routine preventive dentistry and fissure sealing of posterior teeth. At examination 4 years after the procedure, the maxillary left permanent lateral incisor tooth remained positive to pulp testing. Periodontal probing around this tooth was 2 to 3 mm, and a normal periodontal space and bone regeneration on the distal aspect was revealed by a periapical radiograph. Three mm loss of attachment and a deficient interdental papilla was still

present distal to the maxillary left permanent lateral incisor tooth, however, the patient was not concerned about the appearance caused by this defect.

Contact with the patient was lost for the following 5 years. Nine years after surgery, the author (CO) traced the patient, now 21 years old. A clinical examination at this time showed that the maxillary left permanent lateral incisor tooth remained positive to sensibility testing. Oral hygiene was poor, and chronic marginal gingivitis was evident (Fig 6). Three mm loss of attachment was noted on the distal aspect of the maxillary left permanent lateral incisor tooth, while periodontal probing remained at 2 mm around the maxillary left permanent central incisor, the maxillary left permanent lateral incisor, and the maxillary left permanent canine teeth. A periapical radiograph showed a periodontal space of normal width, with some loss of vertical bone height (Fig 7). Early interproximal caries was seen on the maxillary left permanent central incisor, the maxillary left permanent lateral incisor, and the maxillary left permanent canine teeth. Radiolucencies resembling external root resorption at the cervical margins of crowns were seen on this

radiograph, however, no pathology was detected clinically. Dietary advice, professional tooth cleaning, and topical fluoride treatment was given, and restoration of carious lesions recommended.

### Case report 2

A 12-year-old Caucasian male was referred to the Orthodontic Department, Royal Dental Hospital of Melbourne, for management of a mild Class II Division 2 malocclusion. On examination, the patient was noted to have a brachyfacial skeletal pattern

and a mixed dentition with a Class II Division 2 incisor relationship. The maxillary right permanent lateral incisor tooth was described as geminated, and was in dental crossbite. The patient was then referred to the Children's Department of the Royal Dental Hospital of Melbourne for assessment and management of the maxillary right permanent lateral incisor tooth prior to orthodontic management.

Upon assessment by a pediatric dentist, it was noted that the 2 portions of the maxillary right permanent lateral incisor complex were of differing morphology, were joined by enamel and dentine, and had 2 separate root canals, as revealed by periapical radiographs (Figs 8 and 9). It was thought that the maxillary right permanent lateral incisor tooth was not geminated, but rather was fused to a supernumerary tooth. A treatment plan involving surgical removal of the mesial portion/supernumerary tooth, followed by a 1-stage guided tissue regenerative procedure using Vicryl (Johnson & Johnson Consumer Products, Inc, Skillman, NJ) periodontal mesh membrane was proposed. Informed consent was obtained from both the patient and his mother for the procedure to be undertaken using local anesthesia.

Using infiltration of Xylocaine with 1:80000 adrenaline local anesthetic, labial and palatal full thickness mucoperiosteal flaps were raised. A labial relieving incision was located on the distal aspect of the maxillary right permanent canine tooth. The tooth complex was divided using a high-speed tapered diamond bur and saline irrigation. The cut was performed blind, extending vertically adjacent to what was estimated to be the line of fusion, as the tooth complex was positioned distopalatal to the maxillary



Fig 5. Case 1—periapical radiograph of maxillary left permanent lateral incisor tooth 3 months after surgery



Fig 7. Case 1—periapical radiograph of maxillary left permanent lateral incisor tooth 9 years after surgical removal of fused supernumerary portion, indicating radiolucencies at cervical margins of crowns



Fig 6. Case 1—maxillary left permanent lateral incisor tooth 9 years after surgical removal of fused supernumerary portion



Fig 8. Case 2—maxillary right permanent lateral incisor tooth fused to supernumerary tooth at presentation

right permanent central incisor tooth. Immediately after removal of the mesial portion, a periapical radiograph was exposed, revealing that some of the supernumerary portion remained attached to the maxillary right permanent lateral incisor tooth. Over a period of 30 minutes, the mesial portion of the maxillary right permanent lateral incisor tooth was further sequentially reduced following assessment by 2 subsequent periapical radiographs. A Vicryl periodontal mesh membrane extending under the labial and palatal flaps was placed over the surgical defect and located with multiple Vicryl sutures (Fig 10). Amoxicillin (250 mg tid for 1 week), Panadeine forte tabs (1 tab every 4 hours) for pain as required and a Chlorhexidine mouthwash, (0.2% aq tid) commencing 24 hours postoperatively, were prescribed.

Oral hygiene instructions were reinforced at review at 1 week following surgery. Healing was satisfactory. The mesial surface of the maxillary right permanent lateral incisor tooth was recontoured 3 months after surgery. Subsequent reviews over the following 12 months showed satisfactory healing. The maxillary right permanent lateral incisor tooth remained positive to sensibility testing. Periodontal probing surrounding the right permanent lateral incisor tooth remained at 2 to 3 mm. Periapical radiographs revealed bone regeneration in the surgical defect, and a periodontal space forming at the site of sectioning. A radiograph taken 3 months after surgery showed bone regeneration and a periodontal space of normal appearance (Fig 11).



Fig 9. Case 2—periapical radiograph of maxillary right permanent lateral incisor tooth fused to supernumerary tooth



Fig 10. Case 2—resorbable Vicryl membrane in situ after surgical removal of supernumerary portion

The patient subsequently underwent orthodontic correction of his Class II Division 2 malocclusion, using maxillary and mandibular fixed appliances. A 5-year follow up of the patient, now 17 years old, showed the maxillary right

permanent lateral incisor tooth to be of normal color, to have surrounding periodontal probing depths of 2 mm with 2 mm loss of attachment, and to be positive to pulp testing. A periapical radiograph revealed a periodontal space of normal width with a slight loss of vertical bone height (Figs 12 and 13).

## Discussion

Conventional surgical division of fused teeth with separate root canal systems has provided less than satisfactory long-term clinical outcomes.<sup>4,5,7</sup> Long-term follow up of these 2 cases shows that surgical division followed by guided tissue regeneration can provide good outcomes without significant and progressive periodontal deterioration for these traditionally hard-to-manage dental anomalies.

The presence of a single pulp canal contraindicates sectioning of fused anterior teeth. Where 2 separate pulp canals are present, care must be taken to avoid perforating the root of the tooth to be retained while surgically dividing the portion to be removed. A root perforation or communication carries the risk of devitalizing the retained tooth.<sup>7</sup> Surgically separating fused teeth also carries the risk of initiating external root resorption.<sup>9</sup> Even if external resorption can be treated and restored, the weakened tooth will have a poor long-term prognosis.<sup>13,14</sup>

Where access is favorable, surgically separating fused teeth remains technically demanding, as bone must be removed from the labial aspect to expose the line of fusion without damaging the root surface. Where access to the line of fusion is poor, as in Case 2 where the line of fusion was located to the distopalatal aspect of the maxillary right



Fig 11. Case 2—periapical radiograph of maxillary right permanent lateral incisor tooth taken 3 months after surgery



Fig 12. Case 2—maxillary right permanent lateral incisor tooth 5 years after surgical removal of supernumerary portion while the patient was undergoing orthodontic treatment



Fig 13. Case 2—periapical radiograph of maxillary right permanent lateral incisor tooth 5 years after surgical removal of supernumerary portion, indicating some loss of vertical bone height

permanent central incisor tooth, sectioning must be performed blind, extending vertically to the most apical site of fusion. A cautious approach whereby the surgical cut is biased to the sacrificed tooth side of the estimated line of fusion is recommended, followed by radiography to verify completeness of supernumerary tooth removal. Further pairing away of the retained root portion may then be undertaken if necessary. Surgical division, if performed under local anesthesia, must be completed within 30 to 40 minutes while anesthesia remains profound.

Guided tissue regeneration involves either a 1-stage or 2-stage surgical technique.<sup>11</sup> Initially, a 2-stage technique using a nonresorbable Gore-Tex polytetrafluoroethylene Teflon membrane was developed—as used in Case 1 where the membrane had to be surgically removed after 6 weeks when periodontal healing was advanced to prevent possible micro abscess formation. More recently, a preferred single stage technique was introduced, utilizing resorbable membranes such as Vicryl periodontal mesh or Gore Resolut XT (WL Gore and Associates, Flagstaff, Ariz) regenerative material, to prevent the need for a second surgical procedure, as used in Case 2.<sup>11</sup>

Restoration of exposed dentin on the sectioned crown face remains problematic. Care must be taken to ensure a smooth and well-contoured restoration to minimize periodontal problems. In Case 1, orthodontic retraction of the adjacent erupting maxillary left permanent canine tooth assisted in the restoration of the sectioned crown face and allowed undisturbed healing of the wound site.

The classification and nomenclature of dental hard tissue defects can be controversial. Case 1 shows a tooth complex consisting of a maxillary lateral incisor tooth of normal appearance and location fused to a laterally positioned tooth of different shape, with a separate root canal. Supernumerary teeth that are not mesiodens (not located in the midline) usually are located distal to the last tooth in each series—in this case, the lateral incisor. The fused complex in Case 1 could not be described as geminated, as the distal portion had a different shape and was of smaller size. In Case 2, the complex was initially described as geminated, however, closer examination showed the mesial section to be smaller and of a different shape. Gemination will lead to 2 dental structures of similar size and shape, with varying

degrees of separation of the dental pulp.<sup>3</sup> In neither case could fusion have been between two normal members of the maxillary dentition, as there was a normal complement of teeth. Examination of the contralateral tooth will help to identify which tooth is the normal arch member.

These 2 cases reporting the long-term management of fused supernumerary teeth to permanent incisor teeth highlight the need for accurate diagnosis, careful treatment planning, and skillful surgery combined with guided tissue regeneration to achieve a satisfactory outcome.

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