Enhanced CPD DO C

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# Electrosurgical Adjunct for Soft Tissue Management of the Paediatric Dental Trauma Patient

**Abstract:** The interface between dental restorations and the neighbouring soft tissue is of key significance for restorative success and longevity. Trauma-related enamel–dentine fractures are frequently present with the restorative challenge of subgingival margins and little remaining tooth structure. This report looks at two paediatric dental trauma patients with extensive crown fractures resulting in subgingival margins, which posed a poor long-term tooth survival. Electrosurgery was used before definitive composite restorations to allow for supragingival margins and access. Each patient attended the Child Dental Health Department at the University of Manchester Dental Hospital for assessment and treatment provision.

**CPD/Clinical Relevance:** This article identifies electrosurgery as an increasingly useful adjunct to restorative management of traumatized permanent incisor teeth in paediatric patients.

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The long-lasting restorative success of composite restorations is based upon a multitude of factors. Principal reasons for failure include secondary caries, wear, fracture and marginal deficiency causing leakage.[1] The position of the gingival margin around the intended restoration can influence the likelihood of any of these factors.[2] A good restorative and cosmetic outcome can be achieved when tissues surrounding the teeth are healthy and stable.[3] Gingival hyperplasia can be an adverse effect of dental trauma, especially if the tooth has an accompanying cervical fracture that extends towards the gingival periphery.[3]

The latest Child Dental Health Survey carried out in 2013 suggested that around one in 10 children between the ages of 12 and 15 years had sustained dental trauma to their incisor teeth.[4] Notably, the permanent teeth most affected by trauma were the upper central incisors. Crown fractures are the most prominent type of dental injury, accounting for 26–76% of dental trauma injuries.[4–6] Less than 7% of crown fractures involve the root.[7] The more coronal the fracture line, the better the chance of a favourable outcome. Subgingival fractures often provide insufficient crown height and pose a restorative dilemma for the dental practitioner.[7]

Crown lengthening allows gingival margins to be surgically remodelled and recontoured for aesthetic, physiological and functional purposes. The procedure intends to gain sound tooth structure above the alveolar crest level, rendering the tooth more restorable.[3,8] Crown lengthening reshapes the gingiva by removing soft tissue. Three techniques commonly used for this include scalpel incision, electrosurgery and laser therapy.[9] Soft tissue cutting with a scalpel can result in excess bleeding, making visibility and moisture control problematic for the operating dentist. Both laser therapy and electrosurgery work with little or no bleeding, which overcomes this issue.[3,10]

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**Figure 1.** A standard electrosurgery unit with a current generator, handpiece, ground plate and foot control.

**Figure 2.** Straight wire electrode tip.

a

b

**Figure 3. (a,b)** Photographs taken at age 10 showed the lost composite restoration of the UR1 and marked gingival overgrowth over the palatal surface. Images also displayed differing gingival heights of the UR1 and UL1, owing to the intruded position of the UR1 and likely early evidence of infra-occlusion secondary to ankylosis.

Electrosurgery has been used in the dental field for almost 60 years, with previous literature discussing its ability to perform a range of treatments.[3,11–13] Indications can include gingivoplasty, gingivectomy, pulpotomy, frenectomy, excision of hyperplastic tissue, tooth uncovering and crown lengthening.[14] Electrosurgery allows the passage of high-frequency electric currents into soft tissues to achieve a controllable surgical outcome.[14,15] The voltage across the circuit drives current through the tip, which generates heat when it meets the resistance of the soft tissues. This causes cutting and coagulation of tissue simultaneously, keeping bleeding to a minimum.[9] The technique can be carried out using light pressure, improving patient comfort and reducing chair time.[14] For paediatric patients who may be anxious or struggle with cooperation, a reduced operating time can be particularly advantageous in securing the completion of treatment.

## Electrosurgery equipment

An electrosurgery unit consists of the current generator, active electrode, passive electrode (the ground plate that must be in close contact with the patient's body) and foot control, which activates or deactivates the unit (Figure 1).[14–16] The active electrode is in the form of a hand-held tip that allows high-frequency waveforms to enter the soft tissue being operated on.[15] These are interchangeable, allowing different cutting techniques depending on the procedure. Single-wired electrodes are used for incision and excision of tissue, loop-wire electrodes can be used for tissue planing, including lowering of interdental papilla, and thicker ball electrodes for coagulation of tissue.

The cases described in this article use a single, thin-wired electrode (Figure 2).[14] This was to allow precise control over the operating area and effective modification of the soft tissue contour with minimal tissue necrosis. Optimum soft-tissue local anaesthesia must be achieved prior to use of the electrosurgical handpiece. While cutting soft tissue, the clinician must keep the tip in continuous movement so that the gingival area is not exposed to high temperatures for a prolonged time.[16,18] After the required gingival tissue has been removed, excess tissue debris can be separated with an excavator. Notably, it is essential for the tip to only ever be in contact with gingival tissue and never with the tooth itself or neighbouring bone.[18] Likewise, metal restorations and materials should be avoided by the electrosurgery tip as adjacent tissues may be damaged.[18]

Contra-indications for electrosurgery include its use in patients with cardiac pacemakers since the flow of electrical energy can hinder the device's function. This risk can be reduced by clinicians using the handpiece in small intervals of fewer than 5 seconds, additionally using the instrument over a small area away from the cardiac device. Nevertheless, a theoretical risk of interference still exists.[19]

## Case 1

An 8-year-old attended the child dental health department following a trauma incident in November 2020, in which she fell over at school and avulsed her UL1. Within 20 minutes, a teacher replanted the tooth, which was reviewed shortly after by her general dental practitioner (GDP), who replanted the tooth in the correct position. Following a referral from her GDP, this patient attended the department with a trauma splint from the UR3 to UL3 and previous extirpation of the UR1 by her GDP.

A consultation with clinical and radiographic assessment confirmed the diagnosis of an intruded UR1 with labial crown displacement and complicated crown root fracture. Initial radiographic views included peri-apical radiographs and a maxillary standard occlusal radiograph of the maxillary incisor teeth. Treatment carried out in the hospital began with attempted orthodontic extrusion of the intruded UR1. This was in accordance with the IADT (International Association for Dental Traumatology) guidance

| Timeline | Age (years) | Setting | Management |
|---|---|---|---|
| November 2020 | 8 | School | Dental trauma sustained, including avulsion injury of UL1 while at school. Replanted by a teacher within 20 minutes |
| November 2020 (day of trauma) | 8 | GDP | The assessment was made with the following findings:<br>■ UL1 avulsed, replantation, mesio-incisal enamel fracture<br>■ UR1 intrusive luxation and labial displacement with complicated crown fracture<br>Treatment as follows:<br>■ UL1 removed and replanted into correct position<br>■ Trauma splint placed from UR3 to UL3<br>■ The UR1 was extirpated<br>■ Referral made to the University of Manchester Dental Hospital |
| November 2020 (later that month) | 8 | Tertiary paediatric dental care | New patient assessment with radiographic imaging (peri-apical and upper standard occlusal views) confirmed the above findings<br>Patient's main concern was about the appearance of their fractured front tooth<br>Treatment plan:<br>■ Enhanced prevention including oral hygiene and diet advice<br>■ Orthodontic extrusion of the UR1 (since the UR1 did not spontaneously reposition after 6 weeks), including orthodontic referral<br>■ Root canal treatment of the UL1 and UR1 with bioceramic endodontic material (total fill putty) and coronal composite restoration<br>■ Definitive incisal composite restoration of the UR1, UL1<br>■ Continue to monitor external inflammatory root resorption |
| November 2021 | 9 | Tertiary paediatric dental care | Insufficient orthodontic extrusion achieved<br>Await orthodontic new patient assessment<br>UR1 and UL1 planned treatment completed |
| January 2022 | 9 | Tertiary paediatric dental care | Review appointment. Peri-apical taken of UR1, UL1 confirming no radiographic change in root resorption |
| January 2022 | 9 | Orthodontic tertiary care | New patient assessment with radiographic imaging carried out<br>Plan as follows:<br>■ Records<br>■ MDT clinic |
| August 2022 | 10 | Tertiary paediatric dental care | Review findings:<br>■ UR1 has lost its definitive composite restoration; however, the coronal seal remained intact<br>■ UR1 palatal gingival overgrowth<br>A diagnosis was made of an infra-occluded UR1 with a complicated crown-root fracture<br>The patient was most concerned regarding the appearance of her broken front tooth<br>Plan was to use electrosurgery around the palatal gingiva of the UR1, followed by placement of a definitive composite restoration with a pre-made cellulose crown. This was agreed to help aid aesthetics while a long-term plan was devised |
| August 2022 | 10 | Tertiary paediatric dental care | Completion of the above treatment over multiple appointments<br>Await MDT clinic in a local tertiary care setting for further management<br>Decision to be made locally regarding orthodontic and restorative management. This will include deciding whether decoronation and root burial is indicated for the infra-occluded UR1<br>Treatment as required to then be carried out by a local provider |

**Table 1.** Timeline of dental management for Case 1.

for the management of intruded teeth.[5] At a 6-month review, it was noted that spontaneous re-eruption had not occurred following the injury. Subsequently, root canal treatment was completed in both the UL1 and UR1 with the placement of an apical barrier with a bioceramic endodontic material. Definitive composite restorations were placed on both the UR1 and UL1. This treatment was completed in November 2021.

This patient's dentition was reviewed

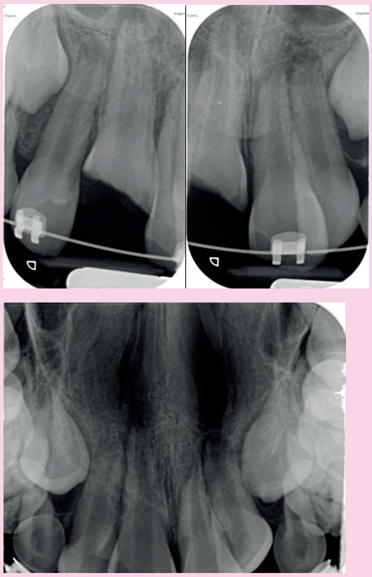
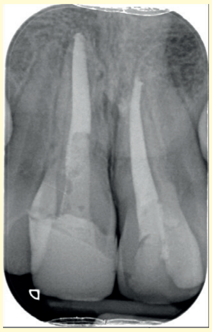
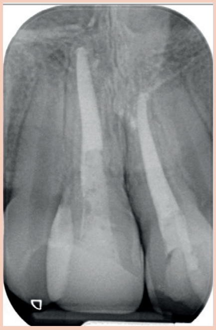
| Radiograph | Time of radiographic assessment and findings |
|---|---|
|  | Peri-apical and maxillary standard occlusal radiographs taken at age 8 showed intrusive luxation of the UR1 with labial displacement of the crown. UR1 has a crown fracture with likely pulpal involvement.[6] Evidence of inflammatory resorption can be seen along the immature root surfaces of the UL1 and UR1 |
|  | Peri-apical taken aged 10 at a review appointment following completion of RCT of both the UR1 and UL1 with bioceramic material. These show voids within the UL1 root filling material. A plan was made to continue monitoring of peria-apical bony healing |
|  | Peri-apical taken at aged 11, demonstrating evidence of replacement resorption associated with the UR1 (evidence of bone growing into resorption lesions). No peria-apical radiolucency is present |

**Table 2.** Timeline of radiographic assessment for Case 1.

a

b

c

**Figure 4.** Photographs taken at age 10 demonstrate the stages of composite crown replacement with the use of electrosurgery and composite crown former. **(a)** UR1 palatal margin following electrosurgery use. **(b)** Fitting of composite crown form before placement. **(c)** UR1 composite crown in place, with a view of the palatal margin after the procedure.

in January 2022 and again in August 2022. The patient complained that her UR1 had lost its composite restoration. Notably, the coronal seal of the UR1 root canal treatment had remained intact, with loss of the composite restoration previously placed and gingival overgrowth around the palatal aspect of the UR1 (Figure 3).

A treatment plan was constructed with a strategy to use electrosurgery around the palatal gingiva of the UR1 prior to the replacement of the definitive composite restoration. This helped improve visual access of the UR1 palatal margin and achieve moisture control for composite bonding. Figure 4 shows the stages of treatment. A full timeline of management, including follow up, is summarized in Tables 1 and 2.

## Case 2

A 12-year-old presented to the child

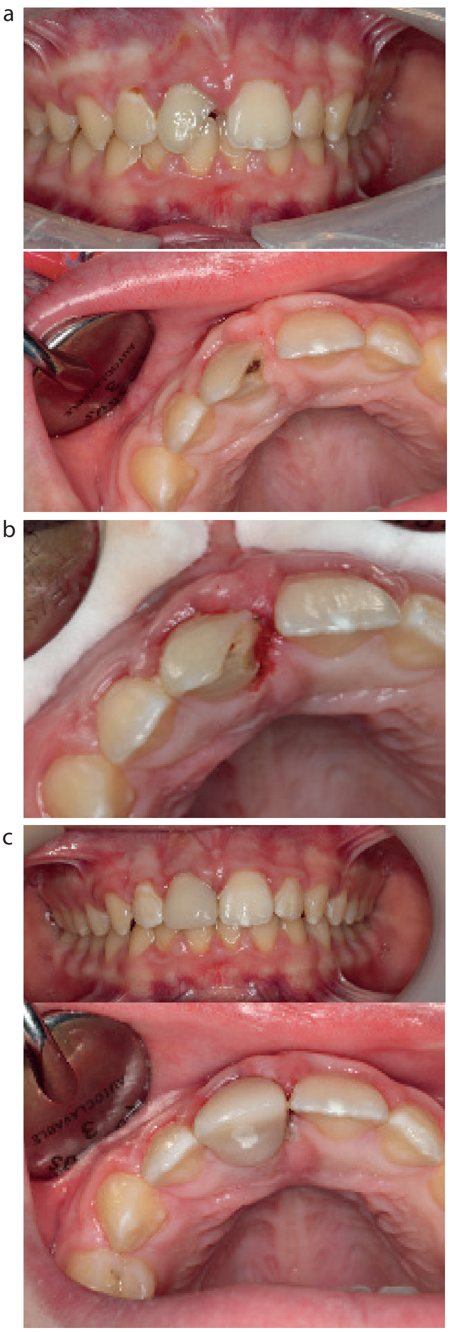


**Figure 5.** Clinical images taken at age 12 demonstrate the treatment stages for composite restoration following electrosurgery. **(a)** Initial presentation of fractured UR1 with subgingival palatal margin and mesial caries. **(b)** The mesial-palatal margin of UR1 following electrosurgery. **(c)** UR1 composite restoration in place, with a view of the palatal margin after the procedure. Note UR1 was accessed for root canal treatment.

| Timeline | Age (years) | Setting | Management |
|---|---|---|---|
| 2017 | 7 | GDP | Dental trauma injury sustained to UR1 when playing at home<br>Confirmed crown fracture, restored with composite |
| January 2022 | 12 | GDP | Re-attended GDP since composite lost from UR1<br>Assessment was made with the following findings:<br>▪ Complicated crown fracture of the UR1 with dental caries and subgingival mesial margin<br>▪ Peri-apical infection associated with the UR1<br>Due to poor cooperation, this patient was referred by the GDP to the University of Manchester Dental Hospital department |
| October 2022 | 13 | Tertiary paediatric dental care | New patient assessment with radiographic imaging (peria-apical views). Diagnoses as follows:<br>▪ UR1 enamel-dentine-pulp fracture extending subgingivally palatally<br>▪ UR1 palatal caries<br>▪ Chronic peri-apical periodontitis associated with the UR1<br>Treatment plan, for completion under inhalation sedation:<br>▪ Enhanced prevention including oral hygiene and diet advice<br>▪ RCT of the UR1 with apexification<br>▪ Electrosurgery of mesial gingiva to allow for definitive composite restoration with pre-made cellulose crown |
| February 2023 | 13 | Tertiary paediatric dental care | Completion of the above treatment over multiple appointments<br>Final radiographic assessment with a peri-apical radiograph<br>Discharged to GDP for active clinical and radiograph monitoring. Radiographic assessment was recommended 6 months post-treatment, followed by once annually for 4 years[20] |

**Table 3.** Timeline of dental management for Case 2.

dental health department in October 2022 following a dental accidental trauma incident in 2017. His GDP had diagnosed an uncomplicated crown fracture of the UR1. This tooth was then restored with composite in primary care.

Upon initial clinical assessment in our department, the UR1 composite restoration had been lost. This patient had a history of recent facial swelling and pain from the UR1. He was asymptomatic at the time of assessment in the department. Trauma checks confirmed UR2–UL2 to be responsive to cold testing, except the UR1, which was negative. Radiographic assessment revealed peri-apical pathology associated with the UR1 and a complicated crown fracture with pulpal involvement).

A treatment plan was formulated that included root canal treatment and composite restoration of the UR1. Gingival overgrowth was noted in the mesial-palatal region of the UR1. The fracture extended subgingivally in this area, which would make it difficult to secure a coronal seal with good moisture control. A decision was made to use electrosurgery before placement of the composite restoration to improve the visualization of the fracture margin and aid moisture control for bonding of the composite (Figure 5). A full timeline of events for this patient, including follow-up, can be seen in Tables 3 and 4.

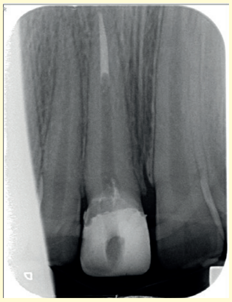
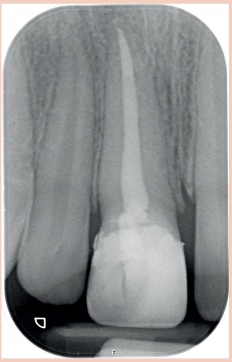
| Radiograph | Time of radiographic assessment and findings. |
|---|---|
|  | Peri-apical radiograph taken at age 12, showing peri-apical pathology of the UR1 and a complicated crown fracture |
|  | Peria-apical radiograph taken age 13, with bioceramic apexification. Notably, this radiograph was not deemed acceptable quality due to the image being elongated and apex of the UR1 cut short |
|  | Peria-apical radiograph taken age 13 with completed root canal treatment and definitive restoration. Longitudinal radiographic monitoring of the UR1 confirmed evidence of bony healing at the apex |

**Table 4.** Timeline of radiographic assessment for Case 2.

## Discussion

The cases discussed in this article display examples of electrosurgery being used to excise gingival tissue extending over a fractured margin of a tooth. This helped to expose the subgingival margin so a supragingival restoration could be placed.[16] Dental trauma cases involving enamel–dentine fractures can include the application of electrosurgery to reveal the fracture line before placement of a restoration.[6] These situations often display minimal supragingival tooth structure and sometimes have margins that extend subgingivally, both of which challenge the dental practitioner.[16] Placing restorations on teeth with subgingival fractures is complicated by difficulty achieving moisture control and limited tooth structure for etching. Often, the resultant restoration fails owing to the loss of retention or marginal integrity. Lowering the gingival margin to create a supragingival restoration helps remove these limitations.[3] Additionally, this provides better access for patients to clean and prevent plaque build up.

Improved visual access of the fracture morphology allows the operating clinician to achieve good moisture control and ensure smooth composite restoration placement. Creating a smooth junction between the fracture line and composite is crucial to help reduce plaque stagnation in the area. A good oral hygiene routine must be reinforced among all patients to prevent caries development at the restoration margin. Use of an enhanced caries prevention plan prior to treatment and at follow up will help ensure restorative success.[21] Paediatric dentists and general dental practitioners must work together to coordinate follow up for these patients, including longitudinal clinical and radiographic assessment.

Earlier literature is available comparing other modalities for soft tissue management in dentistry. These include the use of lasers or traditional scalpel methods.[3,9] Laser-assisted surgeries are typically easy to carry out with little discomfort and bleeding. Healing time also tends to be prompt, with negligible scarring. In contrast to electrosurgery, laser use allows minimal heat production and can be used safely around dental implants. Disadvantages of lasers include slower cutting time and risk of eye damage by laser light, protective glasses are required as a result.[9]

The most widely used soft tissue cutting instrument is the scalpel.[22] This has the advantages of being simple to use, precise cutting and uneventful healing with a lowered risk of unwanted tissue damage to adjacent bone or teeth.[9] This method, however, can result in excessive bleeding and thus impaired visual access as a result of blood build up in the operative field.[13,9] In contrast, electrosurgery allows for immediate haemostasis owing to its coagulation effects. Some disadvantages of electrosurgery surgery include the unavoidable odour of burning flesh, which requires high volume suction during treatment, low tactile receptivity, and contra-indication for patients with pacemakers.[9,13,23] It should be noted that electrosurgery units cannot be used near flammable gases, so care must be taken in individuals requiring inhalation sedation for treatments.[15] This is particularly important for anxious paediatric patients who may plan to use inhalation sedation alongside their treatment. In these instances, sedation must be terminated prior to usage.

The use of electrosurgery in the dental setting has many advantages for aiding restorative management.[14] Tissue incision is clean with little or no bleeding; this provides clear visual access to the site being operated on.[16] However, electro-coagulation can only avoid haemorrhaging at the starting entry to soft tissue.[16] As a consequence, clinicians may find bleeding occurs shortly after the use of the tip. This can be stopped by the application of direct pressure and administration of further local anaesthetic with a vasoconstrictor at the surgical site.[16]

The procedure has reduced chair time for patients, and involves little pressure on the site worked on.[14] Paediatric patients may benefit more from electrosurgery since these factors mean treatment can be shorter and minimally invasive – imperatives for sufficient patient cooperation.[15]

## Conclusion

A demand for more minimally invasive surgical techniques has prompted greater use of electrosurgery in paediatric dentistry. The benefits of reduced patient chair time, minimal instrument pressure and controlled bleeding all support the delivery of child-friendly dental treatment. Electrosurgery stands as a great adjunct for restorative management of the subgingivally fractured incisor tooth. It provides precise contouring of tissues, but also little to no bleeding owing to its coagulation properties. Ultimately, electrosurgery works as an excellent restorative adjunct when managing extensively traumatized permanent incisor teeth. Retention of these teeth allows the preservation of bone in the dental arch, which may generate wider treatment opportunities in the future.

**Compliance with Ethical Standards**

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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**CPD ANSWERS JULY/AUGUST 2024**

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| **1. C** | **6. D** |
| **2. B** | **7. D** |
| **3. B** | **8. B** |
| **4. D** | **9. D** |
| **5. C** | **10. B** |