

Multi-disciplinary emergency management of a severe intrusion injury in a patient with cerebral palsy under intravenous conscious sedation

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Case Summary

A 22-year-old female patient with Cerebral Palsy presented with an intrusive luxation injury to her central incisors following a fall from her bed.

The UR1 and UL1 were intruded approximately 11mm apically from their original position.

Due to the patient's involuntary limb and head movements and reduced muscular control, all radiographs and treatment had to be carried out under intravenous sedation.

Multi-disciplinary input by Restorative and Special Care Dentistry specialists facilitated surgical repositioning and endodontic treatment of the UR1 and UL1 under IV Midazolam conscious sedation.

Patient details

Gender: Female

Age at start of treatment: 22-year-old

Pre-treatment Assessment

History of presenting complaint:

- Trauma to the upper central incisors 17 days prior to presentation.
- Fell out of bed as she was reaching for the remote control.
- Visited a local Community Dental Service dentist after 4 days after the trauma. The central incisors were intruded into the maxilla. No other injuries and no loss of consciousness was reported.

Relevant Medical History:

- Cerebral palsy- spastic quadriplegic
Increased muscle tone and contractions of affected limbs
Partial loss of control of muscular movement
Difficulty supporting own head
- No associated dysphagia- softened and pureed foods only
- Mild learning disability – Unable to communicate fully verbally as unable to articulate words adequately, but able to fully understand.
- No regular medications or known allergies

ASA: 2

Communication: non-verbal communication: nodding for 'yes' and a different movement for 'no'- which was understood by her parents. Some verbal communication was also understood by her parents which was related to the dental team.

No challenging behaviour

Dental History

- Registered with community dental services (CDS)
- Regular attendee, had general anaesthetic for restorations in February 2020 at another trust
- Assisted toothbrushing with electric toothbrush and 1450ppm fluoridated toothpaste
- Diet: thickened foods
- Fully assisted with feeding and moving
- Lives with parents who are her main carers and attends college full time.
- No history of dental treatment under IV sedation
- Wheelchair user- can transfer with assistance and support.

Clinical Examination:

Extra-Oral examination:

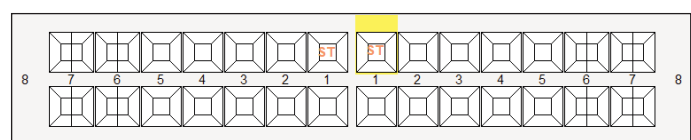
- No associated trismus, asymmetry or facial swelling.
- Incompetent lips at rest, class II skeletal base

Intra-oral examination:

Severe gag reflex when placing instruments near tongue. Difficult to fully assess airway due to inability to keep head still. However, as patient was sedated to reduce gag reflex and involuntary movements, airway would be maintained by the patient and reflexes were still intact. Patient would be treated as upright as possible to minimise any risks.

No soft tissue trauma

Hard Tissues:



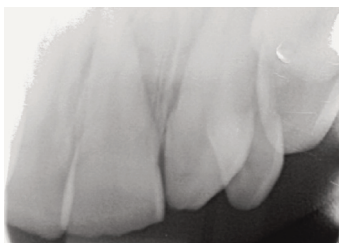
ST=Submerged Tooth

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Unrestored class II division 1 dentition with anterior open bite. UR1 and UL1 intruded apically and displaced by approximately 11mm. Not mobile. No signs of buccal sinus or swelling. Associated gingival inflammation buccal and palatally.

General Radiographic Examination

1. Intra-oral periapicals were taken under sedation of the UR1 and UL1 to assess for crown and/or root fractures or peri-apical radiolucency. Radiographs were very difficult to obtain due to the involuntary movements and associated gag-reflex. Successful images on the second attempt revealed no evidence of fractures or any obvious peri-apical radiolucency.



Periapical radiographs of the UL1 UR1. 19/8/20

Pre-Treatment photographs



A photograph supplied by the patient's mother to demonstrate the dentition prior to the injury.



Lateral and anterior view provided by the patient's mother taken at the time of injury



Photograph at presentation of the UR1 and UL1 with assistance from the patient's mother showing healing of lip trauma.



Photograph at presentation of the severely intruded UR1 and UL1 with associated soft tissue inflammation. – 19/08/20

Diagnostic Summary

- 1) Severe intrusive luxation injury to the UR1 and UL1
- 2) Gag reflex
- 3) Reduced verbal communication due to Cerebral Palsy
- 4) Reduced mobility and muscular tone with excessive involuntary movements due to Cerebral Palsy

Aims and Objectives of Treatment

- Short-term aims: Reposition the teeth to allow healing in a more favourable position. This improved aesthetics and function as well as better access to the root canal system for endodontic intervention.
- Long term aims: Preserve existing dental hard and soft tissues, reduce the risk of infection and encourage replacement resorption rather than inflammatory resorption.
- IV conscious sedation utilised to reduce the gag reflex and involuntary movements to allow dental treatment to be carried out safely and efficiently. Low level clinical holding would be used with the consent of the patient. This would be carried out in an out-patient setting.

Treatment Plan

- I. Examination and radiographic assessment
- II. Oral hygiene instructions and diet advice – especially following splint placement.
- III. Surgical repositioning of UR1 and UL1 with placement of a flexible splint for 4 weeks under IV conscious sedation⁵
- IV. Extirpation of UR1 and UL1 after 2 weeks under IV conscious sedation⁴

- V. Removal of splint and radiographic assessment of UR1 and UL1 under IV sedation
- VI. Root canal treatment of UR1 and UL1 under IV Sedation after 4 weeks
- VII. Clinical review after 2 weeks
- VIII. Radiographic review under IV Sedation in 6 months to assess healing

Treatment undertaken

a. Clinical and radiographic assessment:

Capacity was assessed. Although the patient was unable to fully communicate verbally, she was able to communicate some words as well as 'yes' and 'no' by using sounds and gestures.

The available treatment options as well as the risks and benefits were explained to the patient with support of her parents. Following the principals of the MCA 2005, capacity was assumed unless proven otherwise. The patient was able to understand, retain and weigh up the information and communicate her decision with sufficient support.

Therefore, with sufficient support, the patient was deemed to have capacity.¹⁰ The patient also agreed to allow low-level clinical holding to support her and reduce any potential injuries.⁹

The UR1 and UL1 were surgically repositioned, and a flexible orthodontic wire splint was placed with composite from UR3 to the UL3 under IV sedation using 7mg of Midazolam.

Details of IV Sedation

The patient had a light meal 3 hours prior to the procedure.

Pre-op: BP: 93/73 P: 125 SpO2: 98%

This was obtained by supporting the arm when taking the readings to reduce any involuntary movements and errors.

IV access was obtained in the Right ACF using low level clinical holding to reduce any involuntary movements.

Midazolam was titrated at 1mg increments every 30-45 seconds until the involuntary movements reduced and the gag subsided. Patient was conscious throughout, but very relaxed with an Ellis sedation score of 1 to 2.

Oxygen Saturation was monitored throughout using pulse-oximetry. Capnography was not used as was unavailable.

The procedure was carried out by a separate operator and assisted by 1 dental nurse who was sedation qualified. The conscious sedation was administered by a separate seditionist and there was another sedation qualified dental nurse present as additional support when required and act as a runner.

The patient's parents stayed in the surgery until the patient was adequately sedated for additional support.

The procedure lasted 45 minutes and the recovery was uneventful, lasting 10 mins. No reversal agents were required. Patient was able to transfer with support of her parents.

Post-op BP: 119/87 Pulse: 110 bpm SpO2: 97%

The same process was repeated for subsequent sedation appointments.

Pre- and post-op BP, pulse and SpO2 were within normal ranges. The patient was able to transfer back to her wheelchair with assistance of her parents.

The parents were given standard post-operative instructions and advised to attend local A&E should the patient have any post-op complications.

- b. After 2 weeks, the UR1 and UL1 were extirpated under rubber dam and dressed with calcium hydroxide as per the IDAT⁴ Guidelines using IV Midazolam sedation.

Details of IV Sedation:

Pre-op BP: 104/69 Pulse: 112 SpO2: 98%

7mg of Midazolam was titrated until movements and gag reflex was reduced and patient was still conscious.

Post-op BP: 119/69 Pulse: 99bpm SpO2: 100%

Normal recovery and no reversal agent required.

- c. After 4 weeks the flexible splint was removed, and periapical radiographs taken under IV Sedation using 7mg of titrated IV Midazolam.

Details of IV Sedation:

Pre-op BP: 114/64 Pulse: 102 SpO2: 98%

7mg of Midazolam was titrated until movements and gag reflex was reduced and patient was still conscious.

Post-op BP: 109/62 Pulse: 99bpm SpO2: 100%

Normal recovery and no reversal agent required.

- d. After 4 weeks, the root canal treatments were completed under IV sedation using Pro-taper rotary file system for canal preparation and warm vertical compaction and 3D continuous wave thermoplastic back fill obturation technique. A coronal seal was placed with composite resin.

Details of Sedation:

Pre-op BP: 113/60 Pulse: 104bpm SpO2: 98%

5mg IV Midazolam was Titrated until movements and gag was reduced.

Post-op BP: 106/69 Pulse: 108bpm SpO2: 98%

Normal recovery and no reversal agent required. Patient was able to transfer with support of her parents

- e. A follow-up review appointment was carried out after 6 months. This involved a radiographic assessment under IV conscious Sedation.

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Details of Sedation:

Pre-op BP: 112/69 Pulse: 96bpm SpO2: 100%

5mg IV Midazolam was Titrated until movements and gag was reduced.

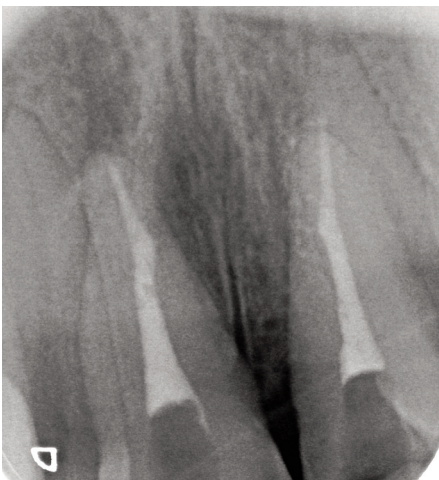
Post-op BP: 97/58 Pulse: 98bpm SpO2: 98%

Normal recovery and no reversal agent required. Patient was able to transfer with support of her parents.

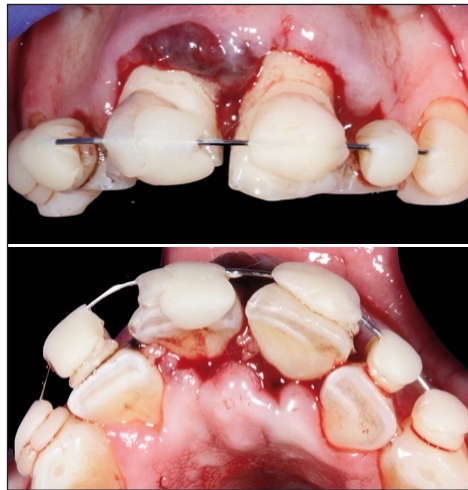
Post Treatment Photographs and Radiographs



Periapical radiograph of UL1 and UR1 following extirpation and calcium hydroxide dressing – 2/9/20



Post-operative radiograph of the UR1 and UL1 showing favourable obturation length and condensation– 18/11/20



Photographs following surgical repositioning of the UR1 and UL1 and splint placement on from UR3-UL3– 2/09/21



Post-operative photo at 6-month review showing good overall healing and improved oral hygiene – 26/05/21

Long-term treatment and future considerations

Long-term treatment:

- 3 monthly recalls at the local Primary Care Community Dental Service for clinical monitoring of the traumatised upper anterior teeth, routine maintenance and monitoring of the dentition and prevention of primary disease.
- Radiographic assessment of UR1 and UL1 under IV conscious sedation should any signs or symptoms appear.

Future Considerations:

- The acute management has increased chance of ankylosis (replacement resorption) and reduced the risk of inflammatory resorption. Whilst replacement resorption is more favourable of the two, this may potentially complicate future extraction of these teeth, if required.

Discussion and reflection about case presented

Intrusion injuries are rare in the permanent dentition¹ but result in the most complex periodontal ligament injury with a significant reduction in 5-year survival.² The combined soft and hard tissue damage can cause loss of gingival attachment, marginal bone loss and root resorption which is more significant when multiple adjacent teeth are involved.³ If the incisors were not repositioned, endodontic access would have been difficult and as this injury

results in a 100% loss of vitality from the blood supply being crushed, there was an increased risk of infection and subsequent inflammatory (infection related) resorption. At this stage the teeth would have healed in a suboptimal position making extraction the only viable option.

Extraction of the UR1 and UL1 could have been considered, however, this would have led to other restorative challenges. As the patient was conscious about her appearance, loss of the upper incisors would have required a prosthetic replacement. Fixed or removable prosthodontic replacement of two missing central incisors is a challenge in any patient due to the limited options available. Dental implant rehabilitation in this patient was not possible and due to the patient's gag reflex a removable partial denture was also not a suitable solution. Any removable prosthesis could also potentially pose a safety risk. With all this in mind, maintaining the patient's own teeth was the best solution possible to help maintain function and aesthetics.¹¹

Timely management was essential to reduce the risk of infection and encourage replacement resorption rather than inflammatory. Allowing the teeth to heal in the intruded position and subsequent orthodontic repositioning could have been an alternative option with the use of intravenous sedation. However, this would have taken a long time, required multiple visits and good compliance from the patient. The time taken to extrude the teeth after allowing the initial healing would have significantly increased the risk of infection. From an endodontic perspective the endodontic intervention should be completed as soon as possible after the trauma and certainly within 2 weeks according to the IADT trauma guidelines.

Given the patient was unable to communicate verbally, by following the principles of the Mental Capacity Act 2005, the patient was able to communicate her decision with sufficient support.¹⁰

The administration of intravenous sedation was challenging as the patient exhibited a degree of involuntary movement and reduced muscle tone. Associated difficulty with head support was overcome using supportive pillows.¹¹ Low-level clinical holding was utilised to safely obtain IV access and reduce the risk of sharps injury to the sedationist, operator and patient. Despite being adequately sedated, the patient still exhibited some slight involuntary movements and reduced head support. Therefore, low-level clinical holding supporting the head was also required during some aspects of the dental treatment.¹¹ Monitoring was also challenging as the pulse-oximeter would often come off the patient's finger due to the spastic muscular contractions of her fingers. This was occasionally overcome by utilising her toe instead of her finger. The need for a separate sedationist as well as additional nursing support enabled the close monitoring of the

patient, maintenance of a clear airway and allowed the operator to focus on completing the dental treatment.⁷ High volume suction and the use of rubber dam aided in the prevention of choking during treatment due to potential swallowing difficulties.⁹

The use of general anaesthesia would have been an alternative option that would have overcome the involuntary movements and gag reflex. However, repeated and ongoing treatment under general anaesthesia would have had an increased risk.⁹ Should treatment under conscious sedation using Midazolam would not have been effective, then consideration of carrying out the treatment under general anaesthesia could have been arranged. However, the treatment plan would have to be re-considered to reduce the risks of repeated general anaesthesia, resulting in extracting the upper central incisors.

Multidisciplinary input was essential to achieve the best dental health outcomes for a patient who suffered a complex and uncommon dental injury made more challenging by uncontrolled movements and a mild learning disability. Skills and knowledge from both Restorative and Special Care Dentistry specialities enabled treatment that may not have been suitably managed without the other team.

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