

Management of dental trauma induced via collision with a rifle sight.

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ABSTRACT

Dental trauma in military populations has been reported to represent 2-8% of all dental emergency cases¹. Predisposing factors to dental trauma in military personnel include the requirement to operate at pace in austere environments, whilst carrying a weapon, in sub-optimal weather conditions and reduced visibility. The SA80A2 (fitted with a telescopic sight) is the standard rifle issued to British Army personnel. When 'patrolling', the rifle is carried at mid- to upper-chest height. During a trip or fall, the rifle sight (especially) may easily impact the facial area. This case report describes the management of a soldier who experienced extensive oro-facial injuries as a result of such an incident. Dental care to the United Kingdom Armed Forces is provided by Defence Primary Healthcare (DPHC), which utilises a Restorative Managed Clinical Network (RMCN) to coordinate and treat complex restorative cases referred from Tier-I care by general dental practitioners (GDPs). The RMCN is Restorative Consultant-led and supported by a geographically located network of Tier-II Dentists with a Special Interest (DWSI) in restorative dentistry. In the case presented, rehabilitation of the traumatised dentition was undertaken principally within a Tier-II setting, with Tier-I elements of care prescribed for delivery by the patients GDP. Management included: extraction, bone grafting, surgical repositioning of displaced teeth, wire-composite splinting, acrylic and Essix-type removable partial dentures, endodontics, bleaching, follow-up/ implant assessment with CBCT, and ultimately definitive replacement of missing teeth with resin bonded bridges. Aesthetic challenges of rehabilitation of the traumatised dentition are discussed.

INTRODUCTION

Dental trauma in military populations has been reported to represent 2-8% of all dental emergency cases¹. Predisposing factors to dental trauma in military personnel include the requirement to operate at pace in austere environments, whilst carrying a weapon, in sub-optimal weather conditions and reduced visibility. The SA80A2 (fitted with a telescopic sight) is the standard rifle issued to British Army personnel (Fig. 1). When 'patrolling', the rifle is carried at mid- to upper-chest height. During a trip or fall, the rifle sight (especially) may easily impact the facial area. This case report describes the management of a soldier who experienced extensive oral-facial injuries as a result of such an incident.



Figure 1. SA80A2 rifle

CASE DETAILS

21-year-old male soldier.

PCO:

- Lost and damaged teeth.

HPC:

- Trauma 6 days ago – fell whilst carrying rifle on exercise in dark.
- Two teeth 'knocked out'. One tooth recovered by patient from ground, which had not been reimplanted.
- Initial management (splinting) by GDP.

PMH:

- Fit and well. Nil medications or allergies.
- In-date for tetanus vaccination.

Social History

- Non-smoker.
- ≤4 units alcohol/ week.

Examination

***Initial presentation at the Defence Centre for Rehabilitative Dentistry (DCRD)
(injury + 6 days)***



Figure 2. Lips at rest



Figure 3. Smile



Figure 4. Upper occlusal



Figure 5. Anterior



Figure 6. Lower occlusal

Special investigations

Pulp testing was undertaken at follow-up appointments, but not the initial appointment.

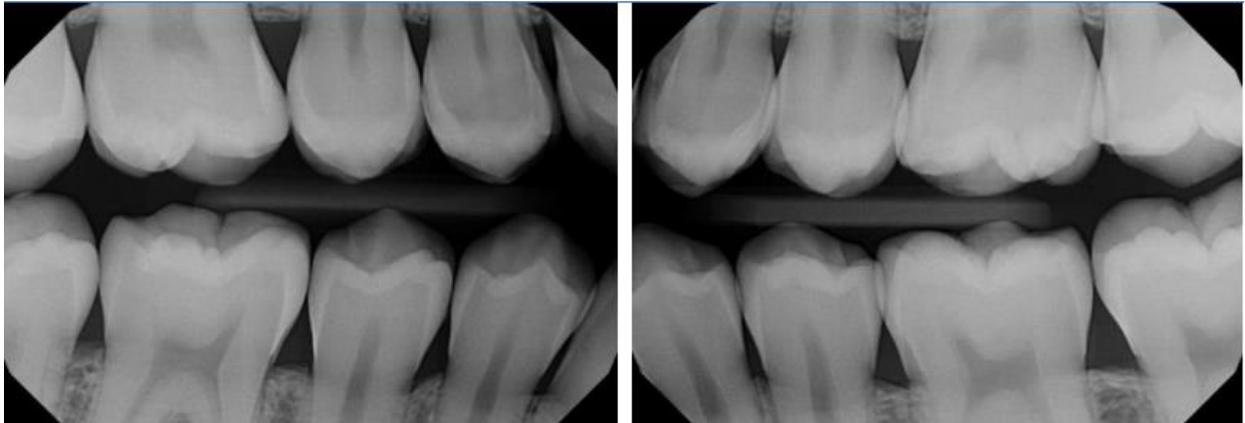


Figure 7. Pre-existing (on file) bitewing radiographs taken 6 months prior to injury:
Caries free and crestal bone levels within normal limits.

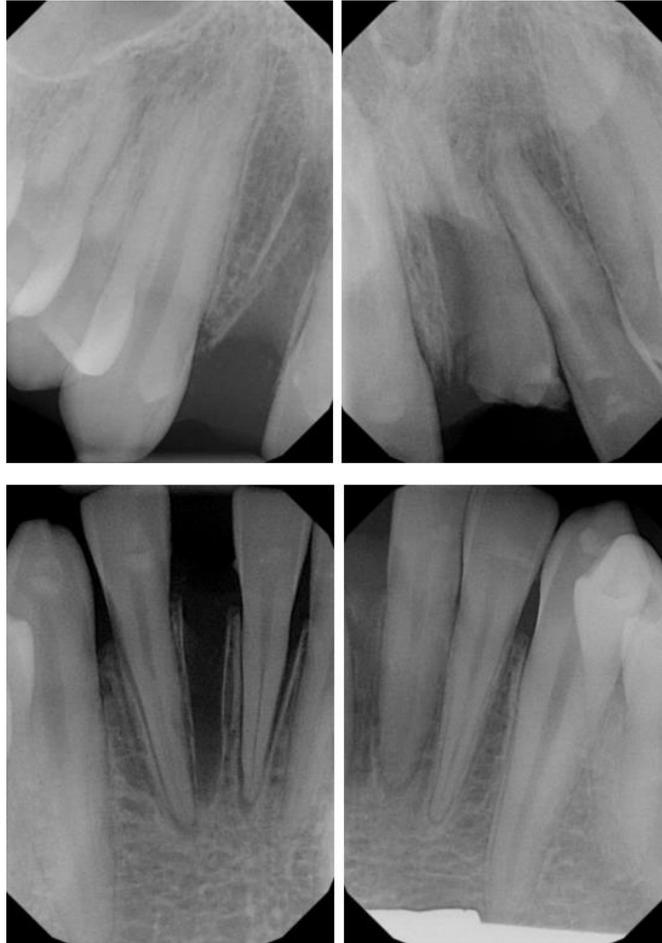


Figure 8. 4 x long cone periapical (LCPA) radiographs, which were taken by referring GDP on day on injury revealed: empty sockets at the 11 and 41 positions; crown-root fracture 21 tooth; and (with respect to socket outline) extrusion of 42 and 31 teeth. 11 tooth not shown.



Figure 9. LCPA radiograph taken upon initial appointment at DCRD, revealed sub-optimal repositioning of the 42 and 31 teeth relative to the outline of their sockets.

Key findings and diagnoses

- a. High smile line.
- b. Abrasion within vermillion and reflected mucosa lower lip.
- c. Laceration (healing) of gingivae labial to 12 socket and 21.
- d. Avulsion 12 and 41. One tooth/ crown accounted for (nil breathing/ abdominal complaints).
- e. 11 tooth:
 - i. Enamel-dentine fracture incisal edge.
 - ii. Intrusion.
- f. 21 tooth:
 - i. Crown-root fracture (decoronated).
 - ii. Intrusion and lateral luxation.
- g. Extrusion and lateral luxation 31 and 42.
- h. Alveolar bone fracture anterior maxilla and mandible.
- i. Lower anterior teeth splinted in sub-optimal position.

Initial treatment plan agreed

- a. Extraction 21.
- b. Debridement 12 and 21 sockets.
- c. Bovine-derived particulate/ collagen graft 21 socket.
- d. Suturing lacerated gingivae.
- e. Reposition 11, 31, and 42 and (wire-composite) splints
- f. Prescription:
 - i. Paracetamol tablets 400mg, 2QDS PRN, supply 32.
 - ii. Ibuprofen tablets 500mg, 1TDS PRN, supply 24.
 - iii. Amoxicillin 500mg capsules, 1TDS, supply 21.
- g. OHI:
 - i. Tooth brushing twice daily (avoiding surgical sites whilst healing).
 - ii. 0.2% chlorhexidine gluconate mouthwash. 5 x 10ml daily oral rinse for 1 minute for 10 days.
- h. Review and suture removal with GDP in 10 days.
- i. Review with GDP in 4 weeks, and:
 - i. Remove splint.
 - ii. Impression for upper partial acrylic removable partial denture (RPD), and lower Essix-type RPD.
 - iii. Open and dress 11, 31, and 42.
- j. Review at DCRD in 6 weeks.

Immediate treatment

Appropriation of treatment items:

- Extraction/ repositioning of teeth/ splinting/ definitive endodontic treatment/ composites/ bridges: completed by myself.
- Graft/ suturing: completed by Surg Cdr Bryce (Consultant in Restorative Dentistry).
- Pre-bending of arch wire: completed by Wg Cdr Stagles (Specialist Orthodontist).
- Dentures/ open and dress 11, 31, and 42/ bleaching: GDP.

1. Existing wire composite splint removed.
2. 21 tooth extracted.



Figure 10. Extracted 21 tooth.

3. 12 and 21 sockets debrided. Suturing. Bovine-derived particulate/ collagen block graft (Bio-Oss[®]) into socket 21.



Figure 11. Bio-Oss[®]

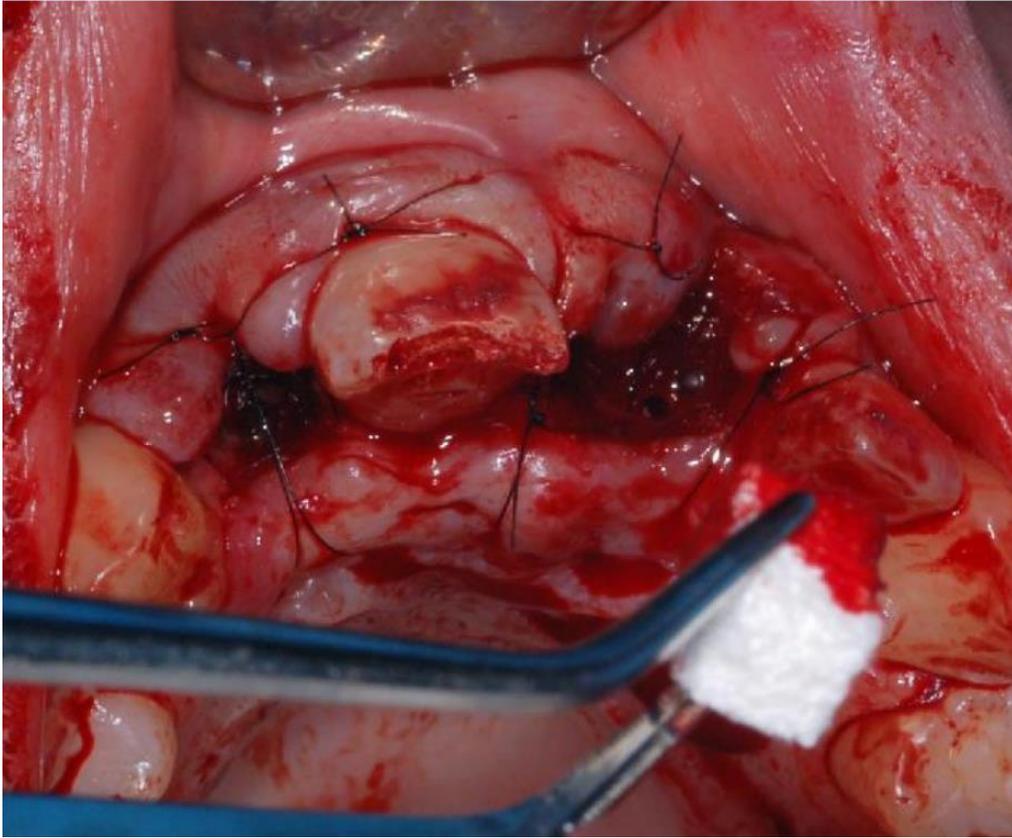


Figure 12. Graft about to be placed

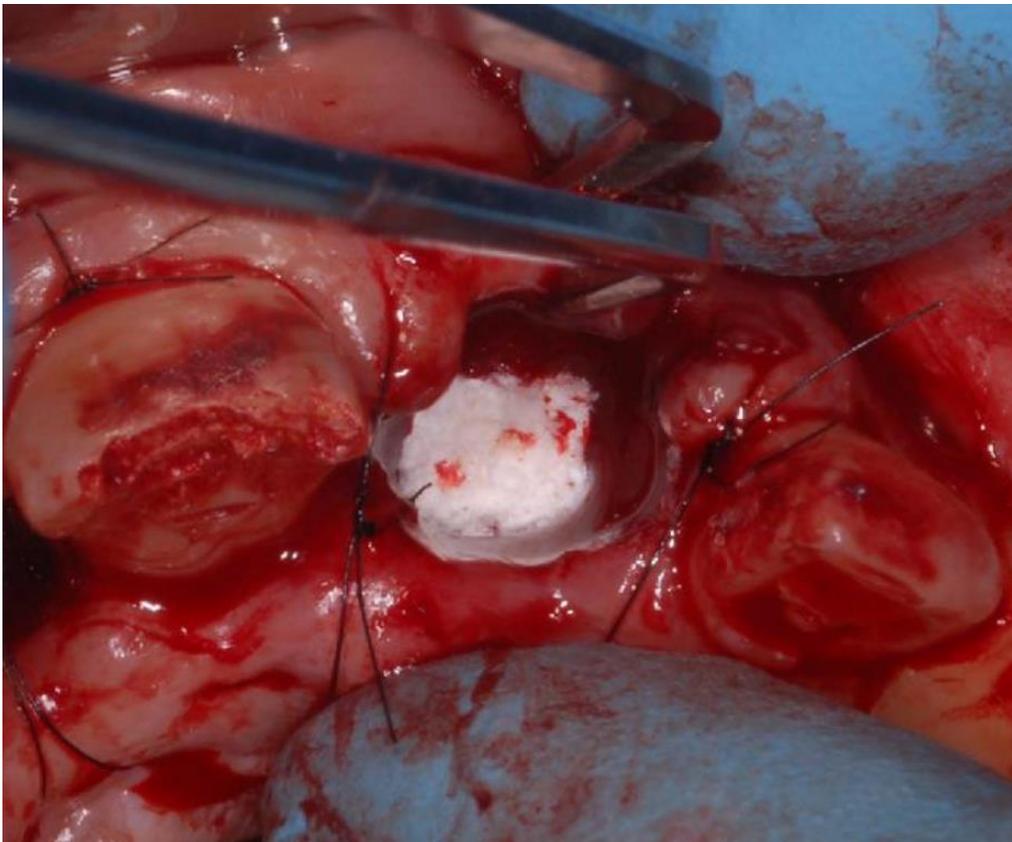


Figure 13. Graft placed

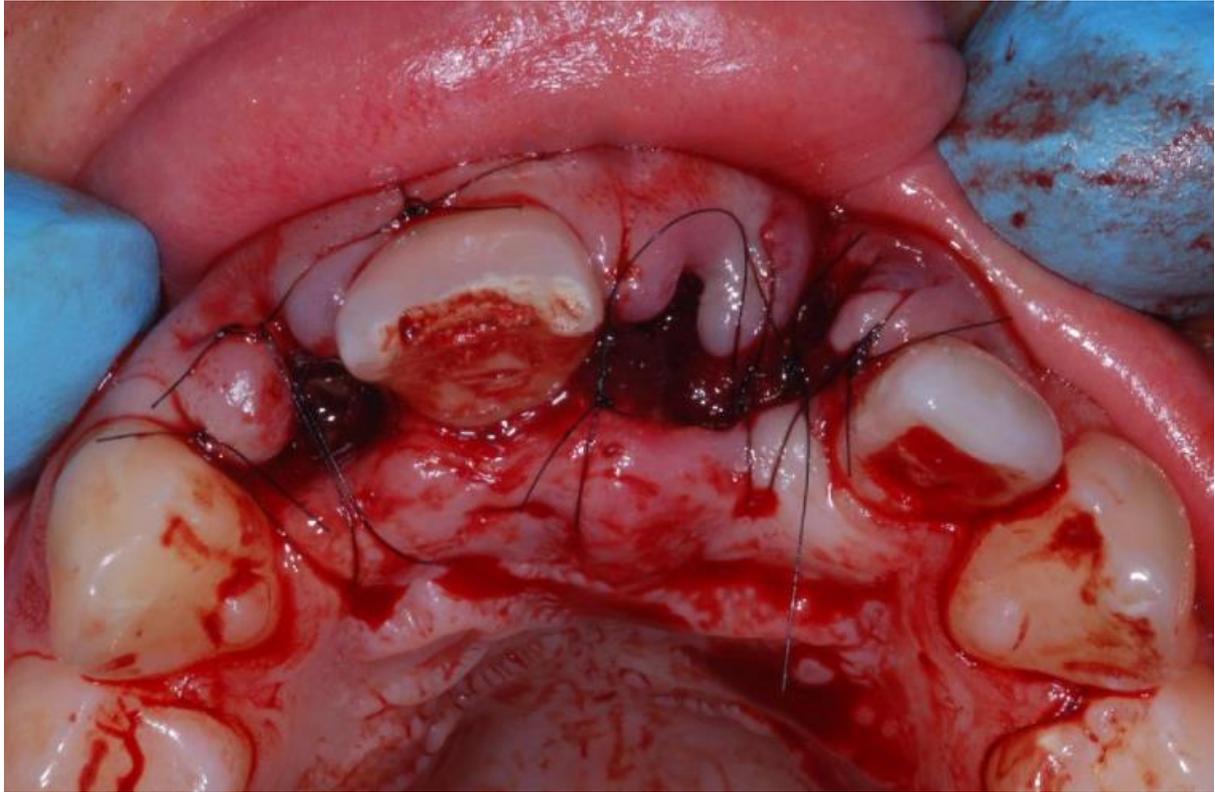


Figure 14. Completed suturing

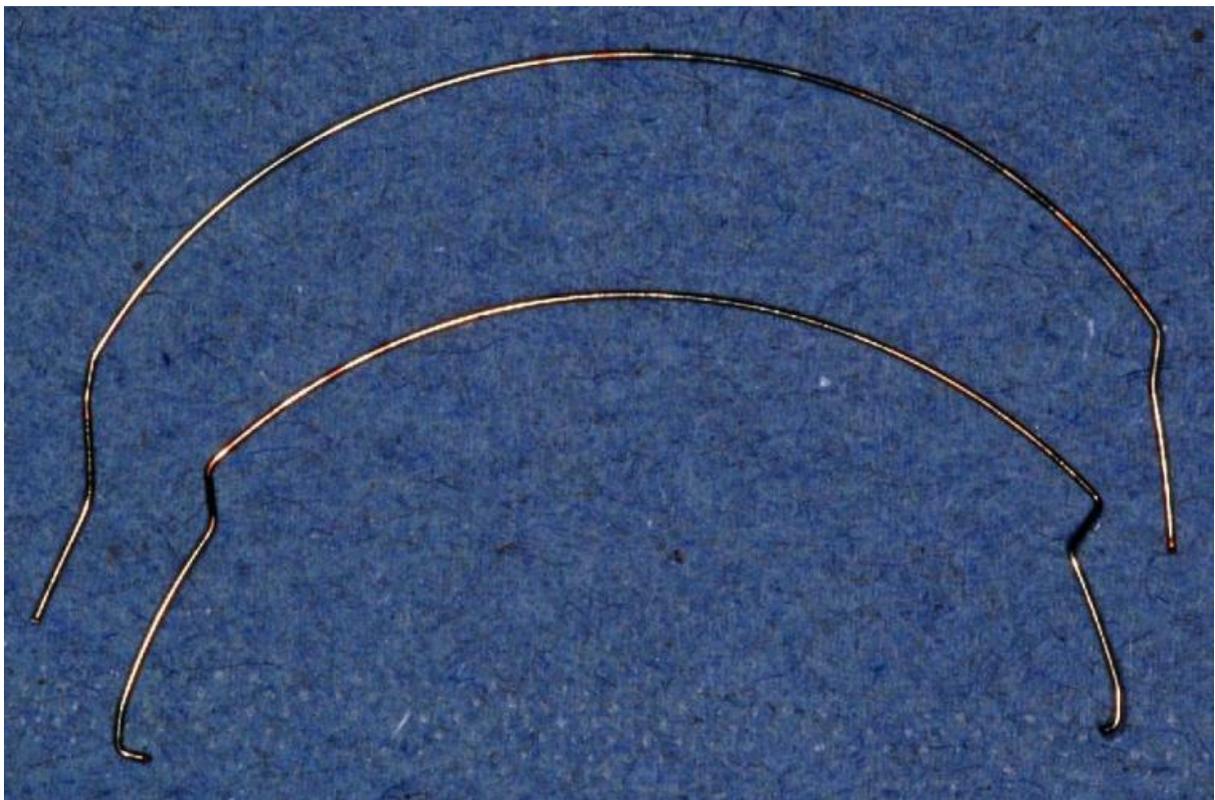


Figure 15. Pre-bent archwire

4. Displaced teeth repositioned with finger pressure and splinted with wire-composite splint.

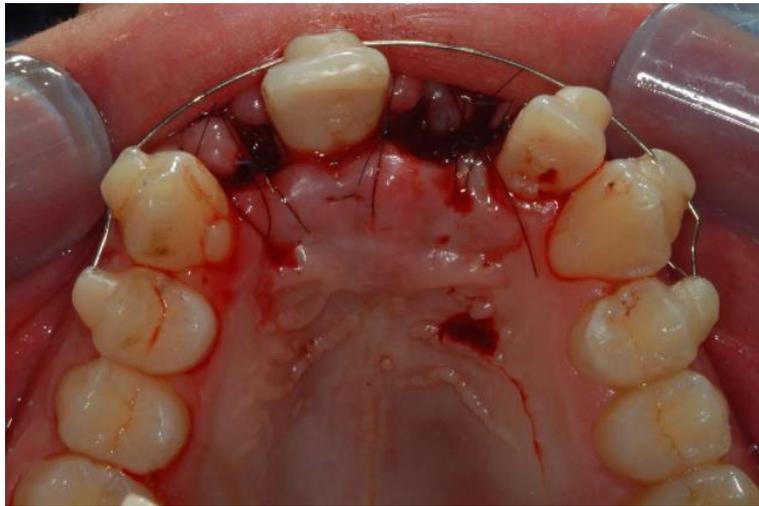


Figure 16. Upper occlusal view



Figure 17. Anterior view



Figure 18. Lower occlusal view

5. LCPA radiographs were taken to confirm satisfactory re-positioning of 11, 31, and 42 teeth, as well as to assess the graft placement within the 21 socket.



Figure 19. Apparent satisfactory repositioning of the 11 tooth with respect to the apical and mesial aspects of the socket wall (noting socket expansion). Satisfactory graft placement. Periodontal ligament (PDL) thickening 22 peri-apically.



Figure 20. LCPA radiograph lower incisors revealed satisfactory repositioning 42 and 31 teeth. PDL within normal limits (WNL) 32 and 33 teeth.

GDP appointment (referral + 10 days): Sutures removed.

GPD appointment (referral + 4 weeks): Splints removed, and endodontic treatment initiated 11, 31, and 42.

GDP appointment (referral + 7 weeks): Upper and lower RPDs fitted.



Figure 21. Upper and lower RPDs.



Figure 22. Upper RPD.
Passive fit on ridge.

DCRD review/ treatment (referral + 10 weeks):

Key findings and diagnoses:

- a. Teeth testing negative with pulp test (Endofrost®): 11, 22, 31, and 42.
- b. Endodontic diagnoses:
 - i. Pulpless 11.
 - ii. Pulp necrosis 22.
 - iii. Symptomatic chronic apical periodontitis 31 and 42.
- c. Discolouration 22 secondary to pulp necrosis.

RCT 31 and 42 completed:



Figure 23. Master apical file (MAF) LCPA Figure 24. Post-operative LCPA

31 and 42 had Vertucci² type-III root canal configuration.

DCRD review/ treatment (referral + 3 months):

RCT 11 and 22 completed:



Figure 25. MAFs in-situ



Figure 26. MAF LCPA



Figure 27. Post-obturation LCPA. Glass-ionomer cement plugs in-situ prior to bleaching. Temporary restoration 11.

GDP treatment (referral + 5 months): Inside-outside bleaching 11 and 22.

DCRD review (including CBCT) (referral + 8 months):

Rationale: screen for pathology/ assess healing and feasibility for implant placement in the 12 and 21 sites.



Figure 28. CBCT 3D model

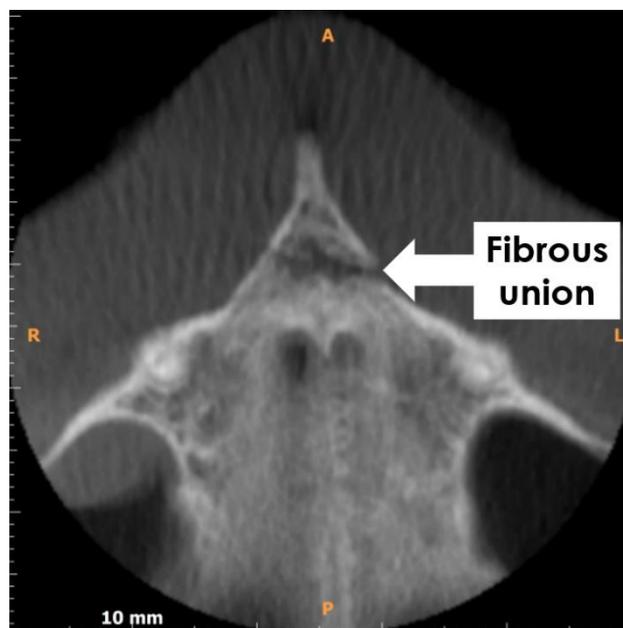


Figure 29. CBCT axial view revealed fracture of the anterior nasal spine, with (likely) fibrous union. Further clinical examination confirmed an absence of symptoms and normal sensation within this region



Figure 30: CBCT sagittal view of 21 extraction site revealed graft in-situ/ significant bone remodelling/ sufficient bone volume for implant placement but quality of bone appeared compromised and likely to challenge implant positioning, with a higher risk of complications.

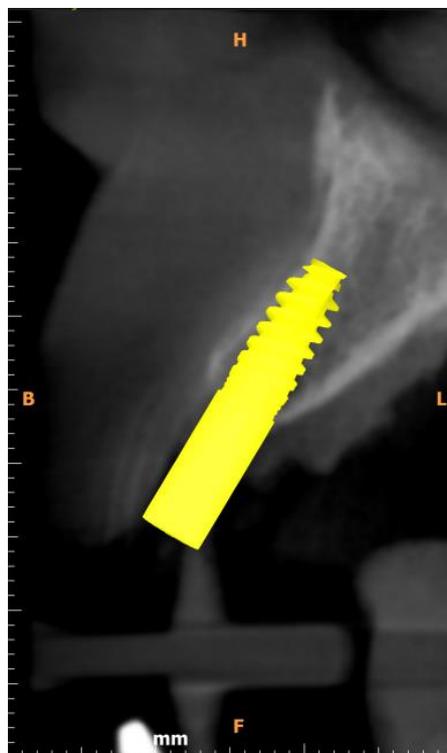


Figure 31. CBCT sagittal view of 12 socket revealed bone remodelling, and that (using an implant blank - 4.3 x 11.5mm NobelActive® implant blank) particulate at the labial aspect would likely be necessary at implant fixture placement.

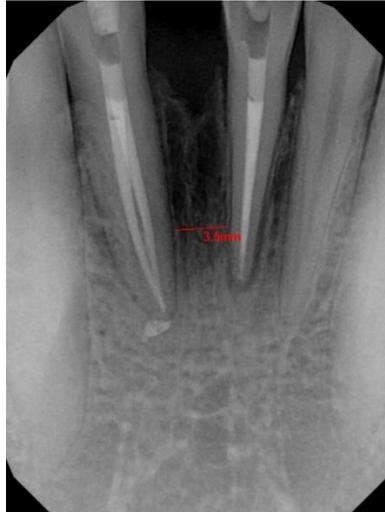


Figure 32. Follow-up LCPA lower incisors. PDL thickened 31 (likely associated with remodelling of traumatised socket). 3.5mm mesio-distal space between 31 and 42 roots – insufficient for predictable implant placement.

Resin bonded bridges (RBBs) selected for definitive prosthetic replacement 12, 21, and 41 as this was judged to represent the most predictable/ least invasive fixed prosthetic replacement option given the circumstances.

Try-in of RBBs



Figure 33. Satisfactory fit and aesthetics 41.
Note blanching of gingivae demonstrating positive fit against soft tissues



Figure 34. Initial try-in of RBBs 12 and 21. Both 12 and 21 pontics monochromatic.
Shape 12 satisfactory. 21 tooth: overly flat in mid-cervical third, and underdeveloped disto-labial line-angle.



Figure 35. Non-permanent pen used to mark areas to be built-up. Shade re-taken.

DCRD review/ treatment (referral + 14 months):

Following refinement of RBBs, the appliances were cemented with Panavia™ V5 opaque cement.



Figure 36. Post-operative upper occlusal view (at bridge fit appointment).



Figure 37. Post-operative anterior view. "Black triangle" between 11/21.



Figure 38. Post-operative lower occlusal view.



Figure 39. Situation upon referral.



Figure 40. Situation upon discharge 14 months later.

DISCUSSION

The initial repositioning of the teeth was sub-optimal. However, it was still possible to successfully reposition the displaced teeth at day 6.

Alveolar ridge preservation (ARP) procedures seek to limit dimensional changes in both the hard and soft tissues following dental extraction³. In this case ARP was more effective at maintaining the bucco-palatal tissue volume than the vertical level. The use of ARP in this case was advantageous, but did not completely overcome the challenge of preventing a "black triangle" between the 11/21 teeth, which could only be partially disguised prosthetically.

The reported incidence of pulp necrosis in mature adult teeth has been reported to be 65% for extrusive luxation and 79% for lateral luxation⁴. In such teeth, it has been recommended that RCT should not be initiated based 'solely on the basis of no response to pulp sensibility testing'⁵. However, this approach should be balanced against the risk of development (and need to manage) complications related to pulp necrosis, including apical periodontitis, intrinsic tooth discoloration, and infection related resorption⁶. Therefore, the threshold for initiation RCT in such compromised teeth should be low.

Root-filled teeth are a sub-optimal choice for use as bridge abutments⁷, due to reduced and altered tooth structure, pre-disposing to increased tooth strain. However, in this case, RBBs represented the most predictable/ least invasive prosthetic replacement option.

CONCLUSION AND CLINICAL IMPLICATIONS

This case demonstrates the utility of a team approach to trauma management within the RMCN framework of the UK Armed Forces. A staged approach to management was adopted, including: emergency, stabilisation, and definitive phases. Forward planning, including consideration around bone grafting and passivity of denture design, contributed to the optimisation of hard and soft tissue healing. The patient was definitively rehabilitated within 14 months of injury. Long-term clinical and radiographic review⁸ is required and has been factored into the patients recall interval.

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