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Staged Panfacial Reconstruction Guided by a Preinjury Orthognathic Plan in a Patient with Blunt Carotid Injury: A Case Report

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Abstract

Panfacial fracture repair is especially difficult when blunt cerebrovascular injury (BCVI) requires antithrombotic therapy and a preexisting malocclusion obscures the intended occlusal endpoint. A 24-year-old woman sustained unstable panfacial fractures in a motor vehicle collision. Computed tomography showed mandibular, Le Fort, zygomaticomaxillary-orbital, and nasal fractures, and diagnostic catheter angiography showed a right internal carotid artery pseudoaneurysm/dissection, corresponding to a Grade III blunt cerebrovascular injury. Preinjury records documented skeletal Class III malocclusion and transverse maxillary deficiency with a planned approximately 5-mm maxillary advancement. Carotid stenting and three staged facial procedures were coordinated within the first two weeks after injury. Preinjury records guided mandibular width correction, maxillary advancement, buttress and orbital repair, and bilateral subcondylar management while aspirin, clopidogrel, and enoxaparin were maintained without interruption. No transfusion, postoperative hemorrhage, neurological event, or wound complication was documented during the available perioperative follow-up, and final imaging showed stable fixation. A preinjury orthognathic plan can provide a patient-specific occlusal target when vascular risk favours staged reconstruction.

Keywords

Antithrombotic Therapy, Blunt Cerebrovascular Injury, Maxillofacial Trauma, Orthognathic Surgery, Panfacial Fracture

1. Introduction

Blunt cerebrovascular injury (BCVI) may complicate high-energy craniomaxillofacial trauma and remain clinically silent before an ischaemic event; screening and early antithrombotic therapy are therefore central to management [1] [2]. Panfacial reconstruction is challenging because normal skeletal landmarks and the premorbid occlusion may be lost, and contemporary reviews favour a patient-specific sequence built from reliable facial units [3]-[5]. When a dentofacial deformity predates injury, reproducing the premorbid occlusion may recreate a known malocclusion. We report staged, record-guided reconstruction in a patient with BCVI and a documented skeletal Class III treatment plan [6] [7].

2. Patient Information and Diagnostic Assessment

A 24-year-old woman was involved in a high-energy motor vehicle collision and was intubated at the scene for a Glasgow Coma Scale score below 8. Facial computed tomography demonstrated a mandibular symphysis fracture, bilateral condylar/subcondylar fractures, a left hemi-Le Fort I fracture, a right hemi-Le Fort III fracture, a right zygomaticomaxillary-orbital floor fracture, and nasal fractures (**Figure 1**). Clinical examination showed marked periorbital oedema and facial and cervical soft-tissue injury (**Figure 2**).

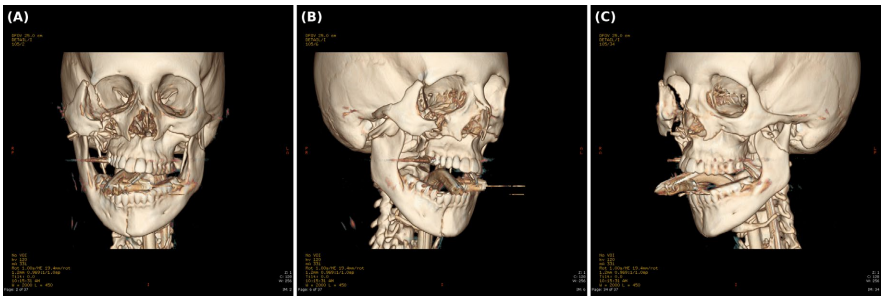

Figure 1. Preoperative three-dimensional computed tomographic reconstructions. (A) Frontal view showing panfacial disruption involving the mandibular symphysis, midface, and orbital buttresses. (B) Right oblique view showing zygomaticomaxillary-orbital displacement. (C) Left oblique view showing the contralateral midface and bilateral condylar/subcondylar injuries. Identifying information has been removed from all radiographic images.

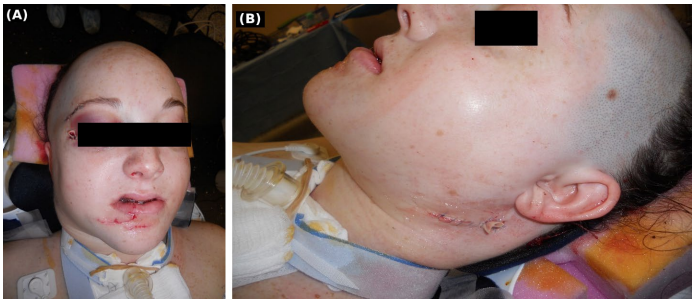

Figure 2. Focused preoperative clinical photographs. (A) Right periorbital oedema, laceration, and soft-tissue injury. (B) Right retromandibular and cervical soft-tissue injury.

Before the collision, the patient had been evaluated by the primary surgeon for skeletal Class III correction. Facial and occlusal photographs documented horizontal and transverse maxillary deficiency, asymmetric mandibular prognathism, negative overjet, and posterior crossbite. The proposed orthognathic plan included approximately 5 mm of maxillary advancement, but surgery had not been performed. She had elected orthodontic treatment without definitive jaw surgery; therefore, the preinjury records reflected both the baseline deformity and the intended correction.

Because of the injury mechanism and fracture pattern, vascular imaging was obtained. Diagnostic catheter angiography demonstrated a right internal carotid artery pseudoaneurysm with associated dissection (**Figure 3(A)**), a finding that corresponds to a Grade III injury in the Biffl (Denver) blunt cerebrovascular injury grading scale, in which pseudoaneurysm formation defines Grade III [2]. The recorded antithrombotic regimen included aspirin, clopidogrel, and enoxaparin, initiated after the vascular diagnosis and documented as continued without interruption thereafter; the individual agent doses and the exact times of initiation were not preserved in the records supplied for this report. The maxillofacial and vascular teams jointly prioritised stroke prevention while planning timely fracture stabilization.

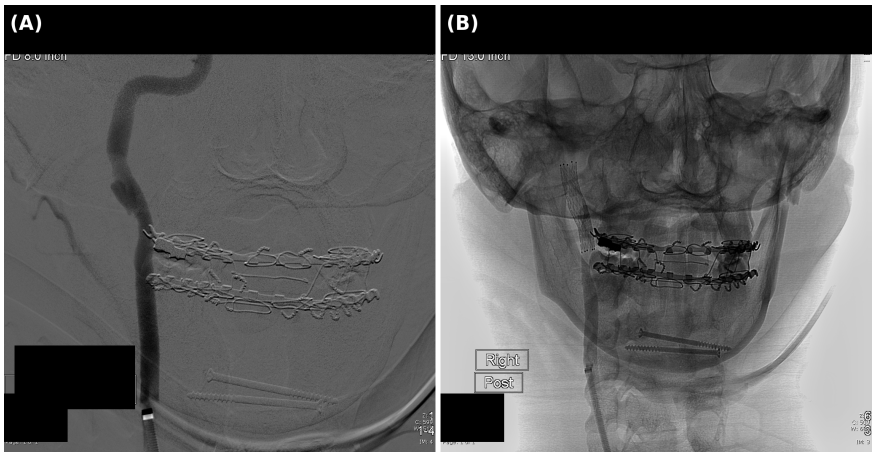

Figure 3. Vascular imaging. (A) Diagnostic catheter angiography demonstrating the right internal carotid artery pseudoaneurysm/dissection. (B) Frontal postintervention image after right internal carotid artery stent placement and before completion of definitive facial reconstruction.

3. Therapeutic Intervention

The clinical timeline, staging, and rationale of the combined vascular and maxillofacial management are summarized in **Table 1**.

3.1. Stage 1: Mandibular Width and Record-Guided Occlusal Platform (Postinjury Day 1)

On postinjury day 1, maxillary and mandibular arch bars were placed under

Table 1. Clinical timeline and rationale.

Time point	Key events and clinical rationale
Injury/day 0	High-energy motor vehicle collision; Glasgow Coma Scale score below 8; field intubation; computed tomography showed panfacial fractures; diagnostic catheter angiography identified a right internal carotid artery pseudoaneurysm/dissection (Grade III); antithrombotic therapy was initiated. Rationale: stabilize the patient and address stroke risk before prolonged reconstruction.
Postinjury day 1	Arch bars, symphyseal reduction and lag/compression fixation, transmandibular narrowing, maxillomandibular fixation, record-guided maxillary advancement, and laceration repair. Rationale: establish mandibular width and an early occlusal platform, maintained thereafter by continuous maxillomandibular fixation.
Postinjury day 8	Repeat vascular imaging showed persistent injury; right internal carotid artery stenting was performed. Rationale: definitive vascular management before completion of complex facial repair.
Postinjury day 9	Right zygomaticomaxillary-orbital repair, Le Fort I fixation in the planned advanced position, and left subcondylar fixation; local hemostatic measures and drains were used. Rationale: complete major buttress reconstruction in a shorter stage while antithrombotic therapy was maintained.
Within two weeks	Right subcondylar fracture repaired separately with controlled segment overlap; no formal mandibular setback osteotomy (exact operative date not preserved in the supplied records). Rationale: isolate the most technically demanding mandibular component and minimize manipulation near the carotid injury.
Available perioperative follow-up	No transfusion, postoperative hemorrhage, neurological event, or wound complication was documented; drains were removed at 48 hours; jaw-mobility therapy began; final computed tomography showed stable fixation. Rationale: document early safety and structural outcome without overstating long-term results.

fibre-optic nasotracheal general anesthesia. The mandibular symphysis was reduced with lag/compression fixation, and transmandibular compression wires narrowed the widened mandibular arch and corrected asymmetry. Maxillomandibular fixation was established, and the maxilla was positioned using the preinjury records, producing a Class I molar relationship and approximately 5 mm of advancement. Facial lacerations were repaired during the same procedure. The preinjury photographs were especially important because traumatic displacement, arch widening, and bilateral condylar injuries made the presenting occlusion unreliable.

The preinjury records used to define the intraoperative occlusal target comprised the facial and intraoral occlusal photographs and the written orthognathic treatment plan documented by the primary surgeon, who had personally evalu-

ated the patient before the collision and who also directed the trauma reconstruction. Because these records documented both the baseline deformity (negative overjet, posterior crossbite, and asymmetric prognathism) and the intended correction, the planned endpoint could be distinguished from the patient's preinjury occlusion: the target was the planned Class I molar relationship with positive overjet, not the habitual Class III intercuspation. The approximately 5-mm advancement was a clinical approximation that was verified intraoperatively against the documented plan by assessment of the molar relationship, overjet, and dental midlines rather than by cephalometric measurement, because complete preinjury cephalometric records were not available.

The record-guided maxillary position established at this stage was maintained between stages by continuous maxillomandibular fixation on the arch bars placed at the first procedure. Maxillomandibular fixation was continued until rigid internal fixation of the maxillary buttresses at the second stage; the arch bars were retained thereafter for occlusal guidance until completion of the staged repair, after which maxillomandibular fixation was released to permit early jaw-mobility therapy.

3.2. Vascular Reassessment and Carotid Stenting (Postinjury Day 8)

Persistent carotid injury on repeat imaging led to urgent endovascular stent placement on postinjury day 8 (**Figure 3(B)**). The vascular team selected stenting because the pseudoaneurysm persisted on surveillance imaging despite medical therapy and because definitive endovascular control was judged preferable before completion of the remaining facial reconstruction; this individualised decision is considered in the Discussion in the context of current guideline recommendations [2]. Because antithrombotic therapy could not be safely interrupted, the remaining reconstruction was divided into shorter operations.

3.3. Stage 2: Midface and Left Subcondylar Reconstruction (Postinjury Day 9)

The second facial stage was undertaken on postinjury day 9, once definitive endovascular control had been achieved; the immediate indication for the preceding delay was the unresolved carotid injury. During this stage, the right zygomaticomaxillary complex and orbital floor were repaired through lateral brow and lower blepharoplasty approaches. The Le Fort I component was reduced and rigidly fixed with bilateral L-plates at the piriform and zygomaticomaxillary buttresses while maintaining the planned maxillary position. The left subcondylar fracture was fixed through a retromandibular approach. Local vasoconstrictor, ligation, electrocautery, layered closure, and dependent drains were used for hemostatic control. Interim computed tomography confirmed the midface reconstruction and persistent superior displacement of the right subcondylar segment (**Figure 4**).

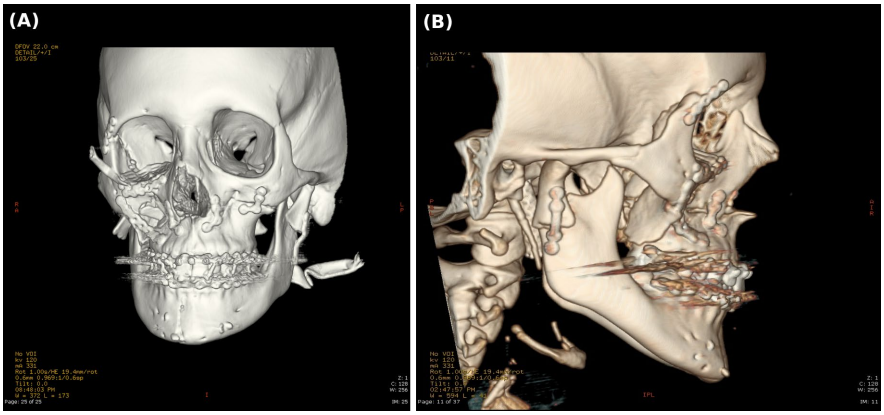

Figure 4. Interim three-dimensional computed tomographic reconstructions after the second facial stage. (A) Midface reconstruction and partial mandibular fixation. (B) Persistent superior displacement of the right subcondylar fracture before the third-stage procedure.

3.4. Stage 3: Right Subcondylar Management

The more superiorly displaced right subcondylar fracture was addressed in a third stage approximately one week later; the exact operative date of this stage was not preserved in the supplied records, but all facial fractures were treated within two weeks of injury. This component was deliberately deferred so that the most technically demanding dissection, adjacent to the stented carotid system, could be performed as a short, focused procedure under uninterrupted antithrombotic therapy and after interval imaging had clarified the position of the displaced segment. No formal mandibular setback osteotomy was performed. Instead, controlled overlap of the proximal and distal segments, analogous to the lateral segment overlap accepted after intraoral vertical ramus osteotomy [8], permitted posterior seating of the distal mandible and restoration of the planned occlusion without forceful manipulation adjacent to the injured carotid system.

The overlapped segments were stabilised in the reduced position, and occlusal control was provided by the arch bars and guided function, in a manner comparable to the postoperative management of intraoral vertical ramus osteotomy, after which the overlapped segments are likewise permitted to heal without anatomical end-to-end reduction [8]. Condylar seating was assessed intraoperatively by manually seating the condyle in the glenoid fossa with the teeth held in the planned occlusal relationship, and the final construct was reviewed on postoperative computed tomography (**Figure 5**). Early postoperative assessment documented a reproducible occlusion at the planned relationship, and no new facial nerve weakness was documented; standardised temporomandibular and neurosensory measurements were not available in the supplied records.

4. Follow-Up and Outcomes

The available follow-up interval extended from injury through the early postoperative period after the third stage, concluding with the final three-dimensional computed tomography; standardised later follow-up visits were not included in

the records supplied for this report. Outcome statements are therefore based on the operative, anaesthesia, and inpatient records and on the imaging reproduced here, rather than on protocolised outcome instruments. Antithrombotic therapy was reported to have remained uninterrupted for the maxillofacial procedures, although, as noted above, the individual agent doses were not preserved in the supplied records. The patient required no transfusion, and no postoperative haemorrhage, neurological event, or wound complication was documented during this interval. Drains were removed after 48 hours, and early jaw-mobility therapy was initiated. Final three-dimensional computed tomography demonstrated stable reduction and fixation (Figure 5). Within the available records, the occlusion was documented clinically at the planned relationship, whereas standardised measurements of mouth opening, formal sensory testing, long-term vascular patency surveillance, monitoring for antithrombotic-related complications beyond the perioperative interval, and patient-reported outcomes were not available.

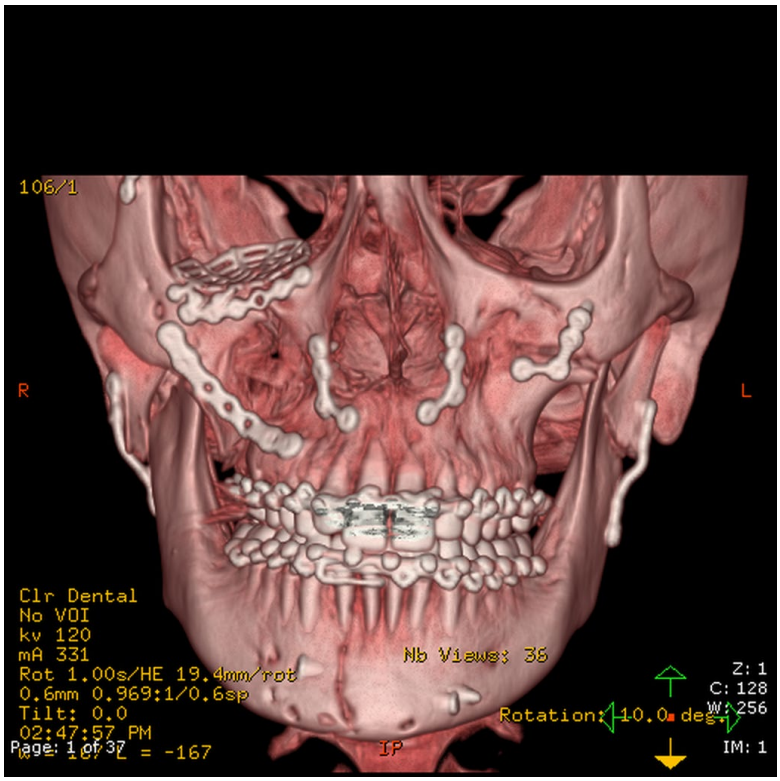

Figure 5. Final postoperative frontal three-dimensional computed tomographic reconstruction demonstrating the restored facial framework and stable hardware after completion of staged fixation.

5. Discussion

The contribution of this case is the convergence of three management problems rather than a claim that any single technique is unprecedented: panfacial reconstruction, BCVI requiring carotid intervention and antithrombotic therapy, and a preexisting dentofacial deformity with an established treatment plan. Cranio-

maxillofacial fracture patterns can identify patients who warrant BCVI screening [1]. Current Eastern Association for the Surgery of Trauma guidance supports antithrombotic therapy after BCVI because it reduces stroke and mortality, while recommending against routine stenting as an adjunct for Grade II or III injuries [2]. In the present patient, stenting was selected by the vascular team because the Grade III pseudoaneurysm persisted on repeat imaging despite medical therapy. The endovascular decision was individualized; this report does not advocate routine stenting. The choice and perioperative handling of antiplatelet and anticoagulant agents remain injury- and centre-specific [2] [9].

The operative sequence first restored mandibular width and an occlusal platform, then reconstructed the midface and left subcondylar unit, and finally treated the technically demanding right subcondylar fracture. This approach is consistent with literature emphasizing reconstruction from reliable structures while tailoring the sequence to the actual fracture pattern and associated injuries [3]-[5].

Prior reports have combined acute fracture fixation with correction of Class III deformity using surgery-first orthognathic principles [6] [7]. The present case differs because the correction was limited, record-guided, and integrated into staged trauma reconstruction under major vascular constraints. Maxillary advancement and symphyseal width correction provided the principal planned changes. The right mandibular relationship was managed during fracture fixation without a formal elective setback osteotomy. This distinction is important: the objective was not comprehensive elective aesthetic surgery during trauma care, but avoidance of reproducing a deformity for which a documented correction had already been planned.

Shorter procedures, reassessment between stages, meticulous local hemostasis, and drain placement plausibly contributed to the uncomplicated perioperative course. Nevertheless, a single case cannot establish the safety of maxillofacial reconstruction during combined antithrombotic therapy or validate controlled segment overlap as a general technique. Additional limitations include the absence of complete preinjury cephalometric data, of documented antithrombotic doses and initiation times, of the exact operative date of the third stage, of the recorded fixation configuration applied to the overlapped right subcondylar segments, and of quantitative postoperative skeletal analysis, standardized mouth-opening measurements, and documented long-term follow-up. Accordingly, the conclusions are limited to the feasibility of individualized multidisciplinary planning in this patient.

6. Conclusion

Preinjury orthognathic records can prevent reconstruction to an unintended occlusion when panfacial trauma occurs in a patient with a known dentofacial deformity. In the setting of BCVI, vascular treatment must remain the priority; carefully staged fracture repair may then reconcile stroke prevention with timely restoration of facial form and occlusion.

Consent for Publication

Written informed consent was obtained from the patient for publication of the case details and accompanying clinical and radiographic images. Identifying information has been removed from all radiographic and angiographic images.

Ethics Statement

This single-patient case report was prepared from existing clinical records and imaging obtained during routine clinical care. According to the authors' local policy, institutional review board approval was not required.

Use of Artificial Intelligence

AI-assisted editing was used only to improve language, structure, and clarity under the direct supervision of the corresponding author. No AI tool generated clinical data, images, or scientific conclusions. The authors remain responsible for verification and approval of the final submitted content.

Author Contributions

All authors contributed to the conception of the report, the drafting and critical revision of the manuscript, and have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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