Revisiting the Boyne procedure

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ABSTRACT

BACKGROUND

The technique involving the free grafting of the mandibular condyle with a vertical ramus osteotomy was described by Philip Boyne in 1987 along with a series of 15 cases where a patient presented with a markedly displaced fracture dislocation of the mandibular condyle.

METHOD

Twenty-one cases (25 condylar fractures) were treated with a modified Boyne technique.

RESULTS

Results showed that we had a complication rate of 12% (8% resorption, 4% fracture of the plate).

CONCLUSION

The Boyne procedure should be thought of as a mainstream treatment method for the displaced fractured mandibular condyle.

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Key Words: Boyne procedure

INTRODUCTION

The Boyne procedure has been used to treat condylar fractures for many years, and we aimed to see whether the complication rate for this procedure was similar to other methods of treating a fractured mandibular condyle.^{1–3}

MATERIALS AND METHOD

A series of 21 cases (25 condylar fractures) were treated with a modified Boyne technique. The ramus was exposed through

sub-mandibular approach and a wire was placed at the angle of mandible to apply traction inferiorly. In all cases, vertical sub-sigmoid osteotomy was carried out with pre-plating prior to the delivery of the proximal ramus segment. The displaced condyle was delivered extra-corporeally and reduced into perfect anatomical reduction to the ramus. The condylar fragment is retrieved from the same incision. A suitable osteosynthesis bone plate was contoured and fixed to the condylar and ramus segment. The pre-plates were re-fixed to the ramus and the assembled osteotomised ramus and condylar segment were reinserted into the correct anatomical position with the meniscus and stabilised. Postoperatively, patients were not placed intermaxillary fixation. Patients were followed-up at one week, three weeks, six weeks, three months, one year, and yearly thereafter. The occlusion and function were commented on within the notes and the radiographs were checked for resorption. Patient interincisal distance was measured at follow-up and each of them was questioned for any daily pain or difficulty with day-to-day tasks (mastication) at six months. The follow-up period was 2–10 years.

RESULTS

Table 1 shows that the vast majority of patients (81%) were involved in interpersonal violence compared to road traffic accidents (RTA) (14%) and sport (5%). It also highlights that in a total of 25 condylar fractures (over 21 patients) there is a success rate of 88%. The operative time varied between 45 minutes and 75 minutes with an average of 60 minutes for the procedure. The follow-up period was between two years and 10 years. In 18 cases, the occlusion and mandibular function was good. There was variable resorption of the condylar head in two cases. There was no correlation between the causes of the fractures and condylar resorption. One case had sustained a fracture of the osteosynthesis bone plate. There was no permanent facial nerve injury. Four out of 21 patients had temporary facial nerve weakness which resolved completely. The minimum normal interincisal distance classified as normal is 25 mm. The results show that three patients had an interincisal distance of <25 mm (13.5%). Three patients (13.5%) reported postoperative pain on a daily basis at six months. None of these patients had unsatisfactory postoperative radiographs. Only one of these patients reported reduced function, and he also had a reduced interincisal distance. Two patients (9%) reported reduced function at six months. Both of these had

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Table 1 Series of results of 21 modified Boyne procedure cases.

Age (yr)	Mode of injury	Unilateral/bilateral	Remarks	Opening (mm)	Patient postoperative daily pain	Patient postoperative reduced function
22	Assault	Unilateral	Satisfactory	26	No	No
14	RTA	Bilateral	Satisfactory	45	No	No
33	Assault	Unilateral	Satisfactory	28	Yes	No
27	Assault	Unilateral	Satisfactory	19	No	Yes
34	Assault	Bilateral	Satisfactory	35	No	No
21	Assault	Unilateral	Satisfactory	48	No	No
18	Assault	Bilateral	Resorption of one condyle	43	No	No
19	Sport	Unilateral	Satisfactory	21	Yes	Yes
21	Assault	Unilateral	Satisfactory	37	No	No
32	Assault	Unilateral	Satisfactory	33	No	No
25	Assault	Unilateral	Satisfactory	39	No	No
27	Assault	Unilateral	Satisfactory	45	No	No
18	Assault	Bilateral	Satisfactory	23	No	No
18	Assault	Unilateral	Resorption of condyle	25	No	No
42	RTA	Unilateral	Satisfactory	43	No	No
25	Assault	Unilateral	Satisfactory	45	No	No
17	Assault	Unilateral	Satisfactory	42	No	No
24	RTA	Unilateral	Satisfactory	32	Yes	No
19	Assault	Unilateral	Fracture of plate	35	No	No
22	Assault	Unilateral	Satisfactory	48	No	No
26	Assault	Unilateral	Satisfactory	37	No	No

RTA: road traffic accidents.

a reduced interincisal distance. Of the three patients who had a reduced interincisal distance, only one (4.5%) reported pain and reduced function at six months. One (4.5%) with reduced interincisal distance reported no pain but had reduced function at six months.

DISCUSSION

While the incidence of condylar fracture is as high as 30%, the management has always been controversial.⁴ Essentially there are three modalities of treatment, conservative, closed reduction with intermaxillary fixation, and open reduction with internal fixation. Following the displacement of the condylar head the ramus of the mandible is telescoped into the glenoid fossa. Hence, even in case of open reduction it is technically challenging to locate, manipulate, and reduce the displaced fragment. The second problem is to maintain the condyle in a stable correct reduced position.

Zide and Kent provide absolute and relative indications for open treatment of subcondylar fractures.⁵ The indications are as follows:

- Dislocation into the middle cranial fossa or external auditory canal.
- Lateral extracapsular displacement.
- Inability to obtain adequate occlusion.
- Open joint wound with foreign body or gross contamination.

However, the small rate of total complications in this series (12%), (8% resorption of the condyle, 4% fracture of the plate) allied with a total rate of complications (13.5%) (9% resorption of the condyle and 4.5% fracture of the plate) in Gupta and Sahoo's series total complication rate in Gupta and Sahoo's series of 18 cases leads us to conclude that this procedure should be considered amongst the mainstream treatment options for the displaced fractured condyle. Interestingly none of the patients with either fracture of the plate or resorption of the condyle suffered from either a reduced interincisal distance, reduced function, or daily episodes of pain. This suggests that a resorbed condyle or a fractured plate in this situation does not necessarily require further surgery.

Two patients (9%) with reduced interincisal distance both had reduced function. This could be attributed to scarring within the joint. Three patients (13.5%) suffered from pain on a daily basis. Many people suffer from pain associated with their temporomandibular joints on a daily basis without suffering trauma. These patients have suffered a significant traumatic injury in requiring this surgery and as such an element of reduced function should be expected in a small number of patients.

CONCLUSION

The 12% complication rate associated with this procedure, allied with the correlation of Gupta and Sahoo's case series,

leads us to believe that this procedure should be considered to be a mainstream treatment option for the fractured mandibular condyle.

Intellectual Contributions of Authors

Study concept: Roger Bainton, Douglas Hammond

Drafting and statistical analysis: Douglas Hammond, Adnan Arafat

Manuscript revision: Douglas Hammond

Study supervision: Roger Bainton

CONFLICTS OF INTEREST

None identified.

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Journal scan

Kotwal RS, Montgomery HR, Kotwal BM, Champion HR, Butler FK Jr, Mabry RL, Cain JS, Blackburne LH, Mechler KK, Holcomb JB. Eliminating preventable death on the battlefield. *Arch Surg* 2011 (published online August 15, 2011). doi: 10.1001/archsurg.2011.213.

To evaluate battlefield survival in a novel command-directed casualty response system that comprehensively integrates Tactical Combat Casualty Care guidelines and a prehospital trauma registry, the analysis of battle injury data collected during combat deployments in Afghanistan and Iraq from October 1, 2001 through March 31, 2010 was carried out. All casualties from the 75th Ranger Regiment, US Army Special Operations Command were scrutinised for preventable adverse outcomes and opportunities to improve care. Comparisons were made with Department of Defense casualty data for the military as a whole. A total of 419 battle injury casualties were incurred during seven years of continuous combat in Iraq and 8.5 years in Afghanistan. Despite higher casualty severity indicated by return-to-duty rates, the regiment's rates of 10.7% killed in action and 1.7% who died of wounds were lower than the Department of Defense rates of 16.4% and 5.8%, respectively, for the larger US military population ($P=0.04$ and $P=0.02$, respectively).

Of 32 fatalities incurred by the regiment, none died of wounds from infection, none were potentially survivable through additional prehospital medical intervention, and one was potentially survivable in the hospital setting. Substantial prehospital care was provided by non-medical personnel. The authors of US Army Institute of Surgical Research concluded that a command-directed casualty response system that trains all personnel in Tactical Combat Casualty Care and receives continuous feedback from prehospital trauma registry data facilitated Tactical Combat Casualty Care performance improvements centred on clinical outcomes that resulted in unprecedented reduction of killed-in-action deaths, casualties who died of wounds, and preventable combat death. The authors further stressed that this data-driven approach is the model for improving prehospital trauma care and casualty outcomes on the battlefield and has considerable implications for civilian trauma systems.

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