Review

Fractures of the mandibular condyle: evidence base and current concepts of management

Khalid Abdel-Galil *, Richard Loukota 1

Oval & Maxillofacial Surgery, Leeds Dental Institute, Clarendon Way, Leeds LS2 9LU, United Kingdom

Accepted 8 October 2009
Available online 8 November 2009

Abstract

Management of mandibular condylar fractures remains a source of ongoing controversy. While some condylar fractures can be managed non-surgically, recognition of fracture patterns that require surgical intervention and selection of an appropriate operative procedure are paramount to success in treating these injuries. The objective of this review is to appraise the current evidence regarding the effectiveness of interventions that are used in the management of fractures of the mandibular condyle.

© 2009 The British Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Keywords: Trauma; Mandibular fractures; Condylar injuries; Systematic review

Methods

Search strategy

An electronic search of the literature directly relating to condylar fracture management was conducted. The databases examined were the Cochrane Controlled Trials Register, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects and the Health Technology Assessment database. Electronic searches were also conducted of the National Library of Medicine’s (NLM) PubMed, Ovid Medline database, Embase, Cumulative Index to Nursing & Allied Health Literature [CINAHL] and Biosis databases up to 2009.

Of 1081 studies and publications identified on the initial search of all databases, 858 were excluded as they were not directly relevant to the subject matter studied. The remaining 233 publications were examined and analysed for the purposes of this review.

Fig. 1 summarises the literature search and selection process in the early stages of the review. The majority of identified literature included case reports and series, descriptions of osteosynthesis techniques, technical notes, letters and editorials. Fig. 2 presents level I and II evidence identified in this review.

Fracture classification as a guide to treatment selection

Classification systems for condylar fractures can offer insight into which fractures might be best treated with open/closed reduction; a usable classification system must be responsive to the contemporary treatment options available to the surgeon.

The lack of consistency in terminology relating to fracture patterns, however, poses a problem associated with the management of these injuries among surgeons and researchers and their reporting in the surgical literature.

Early attempts at fracture classification were rather simplistic and did not help to direct surgical treatment of these injuries beyond closed reduction and maxillo-mandibular fixation.1–3

The Lindahl classification considers factors that include the level of fracture, “dislocation” at the point of fracture,
and the relationship of the condylar head to the articular fossa. Although useful, this classification system is rather complex. 4

Similarly the Spiessl & Schroll classification divides condylar fractures into subjectively assessed high and low subtypes, with and without “dislocation”, but does not allow easy visualisation of the fracture. 5

The sub-classification reported by Loukota et al. (Fig. 3), is also adopted by the Strasbourg Osteosynthesis Research Group (SORG). 6 This classification was analysed retrospectively in a cohort of patients with condylar fractures and found to be simple to use and can help predict treatment need and outcome. 7

The classification of condylar head fractures has been further clarified recently. 36 This should assist and simplify both treatment decision making and standardisation of nomenclature in future work within this field.

Indications for treatment/intervention

In an earlier review of the literature addressing the evolution of treatment modalities, condylar displacement and ramus height instability were considered the only indications for open reduction and fixation of these injuries.

Open reduction and internal fixation (ORIF) was found to provide better functional reconstruction of mandibular condyle fractures than closed reduction (CR) and maxillomandibular fixation. 8 In current day practice, fractures with a deviation of more than 10°, or a shortening of the ascending ramus of more than 2 mm, should be treated with open reduction and fixation, irrespective of level of the fracture. 9

Operative techniques

Surgical techniques, including approaches to the mandibular condyle and ramus have evolved over the last few decades. This is evidenced by the substantial number of reports identified in the searched literature describing the various techniques, both open and endoscopic, used for rigid fixation of condylar fractures.

No trial evidence exists comparing the various approaches described for access to the ramus–condyle region.

Endoscope-assisted ORIF of condylar fractures is now a viable alternative to traditional closed or open reduction techniques and its acceptance continues to grow as more surgeons gain experience. A recent prospective, randomised controlled, multi-center trial concluded that the treatment of condylar fractures with a transoral endoscopically assisted technique is reliable and may offer advantages for selected cases. 19 This included a tendency towards lower occurrence of facial nerve injury, although this was not supported by comparative statistical analyses.

Figs. 4–8 illustrate some of the current osteosynthesis techniques used in condylar fracture fixation.

Assessment scores and outcomes

Several methods, both objective and subjective, have been described for the assessment of outcome following surgery on the temporomandibular joint complex. 10–15

The Helkimo dysfunction score consists of three indices evaluating anamnestic and clinical dysfunction, occlusion and articulation disturbance. It is an accepted valid and reliable tool used to determine the functional outcome after surgery of mandibular and temporomandibular joint disorders, as well as after orthognathic surgery. 13–15

As in most surgical disciplines, clinicians managing patients with condylar injuries are responsible for monitoring and recording outcomes of treatment. This should include functional assessments of jaw mobility and excursions (opening, lateral excursion and protrusion), occlusal changes as well as subjective pain and discomfort. This will facilitate future clinical decision making and assist in the standardised dissemination of treatment results.

Although outcome monitoring and reporting should be encouraged using available validated indices/scores, this is not common practice at present.
Open reduction versus closed management – level 1 evidence

In an early trial, Worsaae and Thorn reported the complications associated with surgical versus non-surgical treatment of unilateral low subcondylar fractures.⁰ Although both groups underwent maxillo-mandibular immobilisation for 4 weeks, they reported complication rates of 4% and 39% in the surgical and non-surgical groups respectively.

A randomised clinical trial assessing occlusal results following open versus closed management of condylar neck or subcondylar fractures found a significantly greater percentage of malocclusion (22–28%) in the closed treatment group.³¹ Earlier non-randomised longitudinal studies from the same group confirmed decreased mandibular motion and reduced posterior facial/ramus height in groups of patients treated with closed reduction and maxillo-mandibular fixation.⁵²,³³

An international prospective randomised trial involving seven centres compared operative and conservative treatment of displaced condylar fractures and yielded results which were clearly in favour of the operative approach.¹⁶ This reported on 66 patients treated for 79 fractures and followed up for 6 months. Evaluation included radiographic assessment, clinical, functional and subjective parameters including visual analogue scales for pain and the Mandibular Function Impairment Questionnaire index for dysfunction. Operative treatment was found to be superior in all objective and all but one subjective functional parameters.

In another prospective single-centre study 22 patients with 26 diacapitular condylar fractures were randomised to receive either ORIF or closed treatment and followed up for 12

---

**Table:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Methodology</th>
<th>Level of Evidence</th>
<th>No. of patients</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Randomised trial</td>
<td>1b</td>
<td>52</td>
<td>Improved function with ORIF</td>
</tr>
<tr>
<td>2000</td>
<td>Randomised trial</td>
<td>1b</td>
<td>137</td>
<td>Improved occlusion with ORIF</td>
</tr>
<tr>
<td>2006</td>
<td>Randomised trial</td>
<td>1b</td>
<td>66</td>
<td>Improved function with ORIF</td>
</tr>
<tr>
<td>2007</td>
<td>Systematic Review</td>
<td>2a</td>
<td></td>
<td>No eligible trials</td>
</tr>
<tr>
<td>2008</td>
<td>Randomised trial</td>
<td>1b</td>
<td>22 (Diacapitular only)</td>
<td>ORIF equivalent to CR</td>
</tr>
<tr>
<td>2008</td>
<td>Meta-analysis</td>
<td>2a</td>
<td>810</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>2009</td>
<td>Randomised trial</td>
<td>1b</td>
<td>74</td>
<td>ORIF equivalent to ENDO</td>
</tr>
</tbody>
</table>

---

**Fig. 2:** Existing level 1 and 2 evidence (ORIF: open reduction and internal fixation; CR: closed reduction; ENDO: endoscopic reduction and fixation).

**Fig. 3:** SORG classification: (1) high/condylar neck fracture; (2) low/condylar base fracture; (3) diacapitular fracture (with permission from Loukota et al.⁶).
Fig. 4. Osteosynthesis configurations for condylar base fractures (with permission, from: Pilling E, Eckelt U, Loukota R, Schneider K, Stadlinger B. Comparative evaluation of ten different condylar base fracture osteosynthesis techniques).
This failed to demonstrate a clear benefit to patients of ORIF versus closed treatment and recommended closed management in these cases. The cohort of patients studied was small however, and only included undisplaced fractures, a major weakness of the study.

The results of a recent meta-analysis were inconclusive regarding whether open or closed treatment should be used for the management of mandibular condylar fractures. This was attributed to the relatively poor quality of the available data and the lack of other important information. The methodological quality of this study was weak, however, and several deficiencies render its conclusions questionable. These include incomplete database exploration, flawed statistical analysis, and lack of adherence to QUOROM standards.

In a prospective, randomised controlled multicentre trial involving centres from North America, Europe and Asia, patients with condylar neck fractures were randomised to receive either open reduction and internal fixation using an extraoral (submandibular, preauricular, retromandibular) approach or a transoral endoscopic procedure. The primary functional outcome measure was investigated using the asymmetric Helkimo dysfunction score at 8–12 weeks and 1 year after surgery. This showed that comparable functional results were achieved after reduction and internal fixation using either technique. A marginally better early cosmetic outcome and fewer complications were the associated advantages of the transoral approach. Although these included a reduced occurrence of facial nerve damage, this was not supported by comparative statistical analyses.

Who should provide care?

The increased focus on quality and efficiency improvement within healthcare has put increasing pressure on surgeons to improve outcomes.

Existing analyses from other surgical disciplines confirm learning curves in which complication rates, variance in
operative time, and operative time all decrease with surgeon experience. Similarly volume of work has been extensively studied as a surrogate for surgical experience and improved outcomes. Given the relatively high incidence of condylar fractures, it is possible to achieve such a volume of work and expertise by a nominated surgeon in most hospital units.

Post-operative morbidity to the facial nerve is often a concern for surgeons performing open surgery for condylar fractures. Published reports, including available level I evidence, shows that permanent facial nerve palsy following ORIF of condylar neck and base fractures is not a major concern. The transoral approach is difficult to perform without endoscopic assistance. Intensive training in endoscopic techniques and the handling of relevant instruments is necessary before the transoral approach for the treatment of condylar fractures can be performed safely and competently. With increasing experience the technique can also be refined, further improving outcomes.

Conclusion

A trend is emerging in the surgical literature confirming superior functional results following open reduction and internal fixation of condylar fractures, where this is indicated. This is supported by existing level I evidence. Endoscopic assistance, performed transorally, may also provide an alternative means for treating a subset of these injuries, reducing visible scar formation and possibly facial nerve damage.

There are still areas of condylar trauma surgery which some surgeons consider controversial: condylar head fractures and displaced paediatric fractures. The use of resorbable osteosynthesis techniques may be of benefit in both these clinical settings; further research is needed in this field. A SORG multicentre prospective randomised controlled trial is planned to study the treatment of condylar head fractures. Regarding paediatric injuries, promising outcomes have been anecdotally reported following fixation of such fractures in children as young as 6 years of age.

Conflict of interest

The authors have no conflict of interest to disclose.

References


