Available online at www.sciencedirect.com

ScienceDirect

British Journal of Oral and Maxillofacial Surgery 57 (2019) 880–885

BRITISH Journal of Oral and Maxillofacial Surgery
www.bjoms.com

Retromandibular transparotid approach compared with transmasseteric anterior parotid approach for the management of fractures of the mandibular condylar process: a prospective randomised study

V.S. Parihar *, T.K. Bandyopadhyay, P.K. Chattopadhyay, S.M. Jacob

Department of Oral and Maxillofacial Surgery, Army Dental Center (Research and Referral), Delhi Cantt, New Delhi, India

Accepted 9 July 2019
Available online 9 August 2019

Abstract

Fractures of the mandibular condyle lead to displacement of the condyle and loss of the height of the ramus. A retromandibular approach is the most commonly used for open reduction and internal fixation (ORIF) of such fractures. We aimed to compare the complications associated with a retromandibular transparotid approach with a retromandibular transmasseteric anterior parotid (TMAP) approach for their management. Thirty patients were randomly selected into two groups (15 in each): Group A comprised the retromandibular transparotid approach and Group B the retromandibular TMAP. The variables evaluated were: operating time, facial nerve injury, occurrence of Frey syndrome, and sialocoele at one week, four weeks, three months, and six months. The mean (SD) age in group A and B was 33.93 (17.97) years and 33.53 (16.15) years, respectively, and there were 28 men and two women. Mean (SD) exposure time in the transparotid approach was 26.93 (5.19) minutes and 25.4 (8.35) minutes in the TMAP approach. The incidence of facial nerve injury was 2/15 patients in the transparotid group and 3/15 in the TMAP group, all of which resolved within six months. The incidence of sialocoele was 2/15 in the transparotid group. The results did not show any significant difference in complications between the two approaches, but the retromandibular transparotid approach provided straight-line access in fractures of the condylar neck, with fewer incidences of nerve injury. The anterior parotid approach, on the other hand, provided easier access for fractures that were medially dislocated or of the condylar base but had an increased incidence of facial nerve injuries.

Keywords: Condylar process fractures; Retromandibular transparotid approach; Retromandibular TMAP approach

Introduction

Condylar fractures constitute 17.5% to 50% of all mandibular fractures.[1,2] Despite abundant research, a number of controversies surround their management, including the value of open or closed treatment,[3] which approach is best for open reduction and internal fixation (ORIF),[1] and which type of hardware should be used to fix the fractured segments.[4]

Various approaches for the management of fractures of the mandibular condyle include preauricular, submandibular, intraoral, retromandibular, and rytidectomy.[5,6] The retromandibular approach described by Hinds and Girroti[7] in 1967 has been the most popular, as it involves a minimal working distance between the incision and the fracture.[5] The approach to the fracture site using a retromandibular incision can be either through the parotid gland, as in the retromandibular transparotid approach,[8] or the parotid may be bypassed by use of the retromandibular transmasseteric anterior parotid (TMAP) approach.[9] Each approach has its

* Corresponding author.
E-mail address: drvsparihar@gmail.com (V.S. Parihar).

https://doi.org/10.1016/j.bjoms.2019.07.010

own benefits and associated complications.[8,9] To our knowledge, only one study to date[6] has prospectively compared the transparotid approach and TMAP approach for fractures of the mandibular condylar process, but the sample size was only five patients/group. With a lack of adequate published evidence, our study was therefore designed specifically to evaluate the complications between the retromandibular transparotid and the retromandibular TMAP approaches for the management of fractures of the mandibular condyles.

Material and methods

We had approval from our institution's ethics committee for a prospective, parallel, randomised, comparative trial, on adult patients who had reported to a tertiary care government hospital with fractures of the mandibular condyle between August 2016 and March 2018. Informed written consent was obtained from all patients who reported to our hospital with mandibular condylar fractures within seven days of injury. The following patients were excluded from the trial: those with fractures of the condylar head; those who had had previous operations in the retromandibular region; those with traumatic open lacerations in the condylar region; those with preoperative injury to the facial nerve or parotid gland; those with parotid gland disease; those on long term chronic immunosuppressant treatment; those who had had radiotherapy to the head and neck; severely obese patients; and those with uncontrolled systemic disease. A total of seven patients were excluded. To take into account the incidence of injury to the facial nerve reported with the retromandibular transparotid[10] and TMAP[11] approaches, and to obtain a power of 80%, we calculated a sample size of 15 in each group (alpha 0.2, beta 0.2).

After inclusion in the trial, patients had orthopantomograms (OPG) and computed tomograms (CT) preoperatively to assess the severity of the fractures and the degree of displacement and dislocation of the condyles. The severity of each fracture was categorised into either condylar neck or condylar base, based on the sub-classification by Loukota et al.[12] A tangential line was drawn perpendicularly to the posterior border of the ramus from the lowest extension of the sigmoid notch on OPG. More than half the fractures that started above this line were considered to be fractures of the condylar neck, but if more than half of the fracture showed below this line, they were classified as fractures of the condylar base.

A preoperative facial nerve assessment was also done in accordance with House & Brackmann's (HB) facial nerve grading system. Interincisal mouth opening and maximum laterotrusive movement to the opposite side of the fracture were recorded in millimetres (mm). The preoperative variables were recorded by a single examiner on the day before operation, and 30 envelopes (15 for a transparotid approach and 15 for TMAP) were prepared before the study. One envelope was randomly opened by the operating surgeon a day before the procedure, thereby allotting the patient to one of the two groups. Group A patients had open reduction and internal fixation (ORIF) of the condylar fracture using a retromandibular transparotid approach, and those in Group B, the TMAP approach. Patients were informed about the surgical approach and its associated complications before operation, but the examiner was unaware of their group allocation. All operations were done by the same surgeon with the standard operating team at the institute. Operating time (mins) was measured from the time taken from the start of the first skin incision up until the exposure of the fracture. The same was communicated to the examiner, who was unaware of the surgical technique used for the patient. The standard surgical techniques of retromandibular transparotid[8] and retromandibular TMAP[9] approaches were followed.

Assessment of outcomes and statistical analysis

Patients were evaluated by the same examiner at one week, four weeks, three months, and six months postoperatively. Primary outcome variables were the incidence of facial nerve injury and complications related to the surgical approach (sialocoele, salivary fistula, and Frey syndrome).

Secondary outcome variables were operating time, interincisal mouth opening, maximum laterotrusive movement, and occlusion. All statistical analyses were done using SPSS Statistics for Windows, version 17.0 (SPSS Inc.). Probabilities of <0.05 were considered to be significant. Inter-group differences were evaluated using Pearson's chi squared test, and a CONSORT 2010 flow chart of the trial is shown in Fig. 1.

Results

A total of 30 unilateral condylar fractures were included in the study, out of which 15 patients had ORIF through a transparotid and 15 through a TMAP approach. No patient was excluded from the trial postoperatively. The characteristics of the patients included in the study are shown in Table 1. The cause of injury was road traffic accidents in all patients, and 19 of them had additional mandibular fractures treated by ORIF. There were no significant differences in the baseline characteristics of the two groups. None of the patients were lost to follow-up.

The mean (SD) exposure times of the transparotid approach were 26.93 (5.19) minutes, while those of the TMAP approach were 25.4 (8.35) ($p = 0.55$). Incidences of facial nerve injury are shown in Table 2. The buccal branch (HB grade 4) and the marginal mandibular branch (HB grade 4) were involved in the transparotid group. All three of these injuries in the TMAP group involved the marginal mandibular branch, with two cases of HB grade 3 and one of HB grade 2. All nerve injuries were transient and resolved within six months.

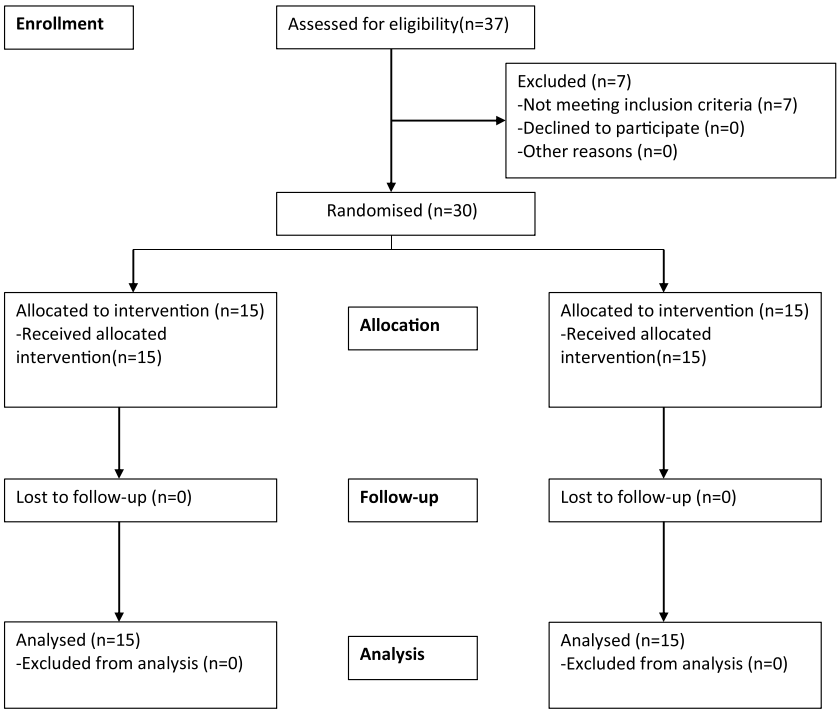

Fig. 1. CONSORT flow diagram of the study.

Table 1
Characteristics of patients included in the study.

	Group A (transparotid)	Group B (anteroparotid)	p value
No. of patients	15	15	–
Mean (SD) age	33.93 (17.97)	33.53 (16.15)	0.4
Sex:			
Males	15	13	0.464
Females	0	2	
Fractured side:			
Left	5	4	1
Right	10	11	
Other associated fractures	10	9	1
Fracture level:			
Condylar neck	8	5	0.46
Condylar base	7	10	
Relation of condylar head with glenoid fossa:			
Dislocated	6	5	1
Not dislocated	9	10	
Relation of fractured condyle with ramus:			
Non-displaced	8	4	
Laterally displaced	7	10	0.239
Medially displaced	0	1	

Table 2
Incidence of facial nerve injury and sialocoele in the study groups.

Outcome and approach	1 week			1 month			3 months			6 months		
	Present	Absent	p value	Present	Absent	p value	Present	Absent	p value	Present	Absent	p value
Nerve injury:												
Transparotid	2	13	0.85	2	13	0.85	2	13	0.46	0	15	–
Anteroparotid	3	12		3	12		0	15		0	15	
Sialocoele:												
Transparotid	2	13	0.52	0	15	–	0	15		0	15	–
Anteroparotid	0	15		0	15		0	15		0	15	

Table 3
Distribution of complication based on fracture level and dislocation.

	Fracture level		p value	Fracture dislocation		p value
	Condylar neck	Condylar base		Dislocated	Not dislocated	
Nerve injury:						
Present	3 (1 TP, 2AP)	2 (1 TP, 1AP)	0.41	2 (1 TP, 1 AP)	3 (1 TP, 2 AP)	0.86
Absent	10	15		9	16	
Sialocoele:						
Present	1	1	0.84	1	1	0.68
Absent	12	16		10	18	

TP, Transparotid approach; AP, Transmasseteric anterior parotid approach.

A total of 2/15 patients treated with the transparotid approach developed sialocoeles (Table 2). Both were treated with occlusive dressings, and one sialocele responded to pressure dressings and subsided in two weeks. The other, however, remained refractory and the patient was taken back to theatre for repair of the parotid capsule under general anaesthesia in the third week postoperatively, after which the complication regressed. There were no instances of salivary fistula or Frey syndrome in either group. One patient in the TMAP group developed a postoperative haematoma that resolved within three weeks. There were no significant differences between the groups in terms of complications, and their distribution based on the severity of fracture and dislocation is shown in Table 3.

Mean (SD) mouth opening increased from 29.13 (9.94) mm to 41.67 (5.47) mm in transparotid group and from 25.53 (7.09) mm to 40.8 (3.49) mm in the TMAP group at 6 months ($p = 0.9$). Maximum laterotrusive movement increased from 5.8 mm to 8.4 mm in the transparotid group and from 6.4 mm to 9.27 mm in the TMAP group at 6 months ($p = 0.07$). Occlusion was satisfactory in all cases. No fractures or failure of hardware were seen in any patient during the study. The resulting scar of the retromandibular incision was imperceptible in 25 subjects (83%) and five developed hypertrophic scarring.

Discussion

Various of approaches such as the preauricular, submandibular, retromandibular, intraoral, endoscopic, and rhytidectomy have been used to gain access to fractures of the condylar process.[13] The preauricular approach is most commonly used for fractures of the condylar head or neck of the condyle, but may require extension of the incision inferiorly for exposure of the mandibular ramus for plate fixation.[1] The submandibular approach has been used for fractures of the condylar base, but the increased distance between the incision and the condylar neck makes reduction and fixation difficult. Anteromedially displaced fragments of proximal fractures are sometimes difficult to reduce using this approach, and excessive retraction is required to gain access to the fracture, which could result in temporary palsy of the facial nerve.[13] When the preauricular approach is chosen, one should minimise the amount of soft tissue stripping from the fractured condylar process and maintain, as much as possible, the attachment of the TMJ capsule and the lateral pterygoid muscle.[14] The endoscopic approach has been described to limit injury to the facial nerve, but it takes longer to reduce and fix when compared with other approaches for ORIF of such fractures.[15]

The retromandibular approach has shown superiority over others as it has a short access route, provides adequate visualisation and access for reduction and fixation, is quick, and results in acceptable aesthetic outcomes.[8] Originally, a transparotid route was described for retromandibular incisions.[16] The approach requires dissection of the parotid capsule and parenchyma of the parotid to reach the fracture site. The TMAP approach was described by Wilson et al[9] in response to concerns about injury to the facial nerve and parotid-related complications resulting from the transparotid route. Anatomically, the TMAP approach uses the window between the buccal and the marginal mandibular branches, and so reduces the chances of nerve damage. As the parotid capsule is not breached, injury to the gland and related complications are also minimised.[17]

Since the first description of TMAP, the approach has been modified by a number of authors.[18,19] The variations have been in the length and size of the superior extension of the incision, with some authors restricting it to the lobule of the ear,[6,19] while others extend it as far as the tragus.[17,18]

The incision that we used was similar in both groups and we did not use preauricular extension. The incidence of temporary facial nerve injury with the TMAP approach in our study was 3/15. The reported incidence of such an injury after TMAP is 3.4%, which is substantially lower than our results.[11] Using the transparotid approach, our incidence of temporary facial nerve injury was 2/15. This is well within the range of 14%-32.1% that has been reported in other studies.[5,8,10,20]

A recent meta-analysis reported the incidence of temporary facial nerve injury with retromandibular transparotid approach as 14.4%.[11] A higher incidence of nerve injury with the TMAP approach in our study could be caused by a number of factors, such as limited sample size and greater traction as a result of the absence of a preauricular extension. Retraction of the parotid posteriorly to expose the masseter may also have caused increased traction on the nerve. According

to the meta-analysis of Al-Moraissi et al,[11] a large number of studies have reported facial nerve injury outcomes using a transparotid approach (28 studies with 1070 patients), while only five studies with 287 patients have reported outcomes using the TMAP approach. Out of those five, only two were classic retromandibular TMAP and the other three were modifications. This could be one of the reasons why there are large variations in the outcomes of the transparotid and TMAP approaches found in previous publications (14.4% compared with 3.4%, respectively).[11]

The incidence of cross anastomosis between the zygomatic and buccal branches of the facial nerve is 87% - 100% while the incidence of cross anastomosis in the marginal mandibular branch is just 15%.[17,21] So, if the buccal branch is slightly injured, the loss of function is minimal, which is not the case with the marginal mandibular nerve. This could be one of the reasons for the higher degree of involvement of this nerve in our study (4/5 cases). There were no incidences of permanent facial nerve injury in our sample with either approach. This is consistent with rate of 1.4% reported with the retromandibular approach.[11]

Salivary-gland-related complications were seen only in the transparotid group, where 2/15 developed sialocoeles. This complication rate is slightly higher than those in other studies. Bhutia et al,[5] in their series of patients with condylar fracture that were managed by the retromandibular transparotid approach, reported a 6.81% incidence of parotid-related complications while Kanno et al,[22] in a similar series, reported a complication rate in salivary glands of 7.27%. No cases of sialocoele, salivary fistula, or Frey syndrome were reported as a result of the TMAP approach.

The primary objective of our study was to compare the incidence of facial nerve injury and parotid gland complications between the two approaches. One of the basic criteria for a comparison is that there should be no differences in baseline characteristics between the two groups. This was fulfilled in our trial by adequate randomisation of the sample. Even though there was a higher incidence of nerve injury with the TMAP approach, and of parotid-gland-related complications with the transparotid approach, there were no significant differences between the groups. This is consistent with the results reported by Ebenezer and Ramalingam,[6] who had found no significant differences in the comparisons of the preauricular, submandibular, retromandibular transparotid, and TMAP approaches. Also, we found that there were no significant differences in the amounts of time taken to expose the fracture sites between the two approaches, and no differences in their functional outcomes.

Ours is one of the few prospective randomised studies to compare the transparotid and TMAP approaches. Our results indicate that there were no significant differences in the complication rate with the two approaches. Further studies from different centres comparing different approaches for the management of fractures in the mandibular condylar process are required to strengthen evidence on this topic.

Ethics statement/confirmation of patients' permission

The study was approved by the institutional ethics committee. The patients' permission was obtained.

Conflict of interests

We have no conflicts of interest.

References

1. Handschel J, Rüggeberg T, Depprich R, et al. Comparison of various approaches for the treatment of fractures of the mandibular condylar process. *J Craniomaxillofac Surg* 2012;**40**:e397–401.
2. Zachariades N, Mezitis M, Mourouzis C, et al. Fractures of the mandibular condyle: a review of 466 cases. Literature review, reflections on treatment and proposals. *J Craniomaxillofac Surg* 2006;**34**:421–32.
3. Berner T, Essig H, Schumann P, et al. Closed versus open treatment of mandibular condylar process fractures: a meta-analysis of retrospective and prospective studies. *J Craniomaxillofac Surg* 2015;**43**:1404–8.
4. de Souza GM, Rodrigues DC, Celegatti Filho TS, et al. In-vitro comparison of mechanical resistance between two straight plates and a Y-plate for fixation of mandibular condyle fractures. *J Craniomaxillofac Surg* 2018;**46**:168–72.
5. Bhutia O, Kumar L, Jose A, et al. Evaluation of facial nerve following open reduction and internal fixation of subcondylar fracture through retromandibular transparotid approach. *Br J Oral Maxillofac Surg* 2014;**52**:236–40.
6. Ebenezer V, Ramalingam B. Comparison of approaches for the rigid fixation of sub-condylar fractures. *J Maxillofac Oral Surg* 2011;**10**:38–44.
7. Hinds EC, Girotti WJ. Vertical subcondylar osteotomy: a reappraisal. *Oral Surg Oral Med Oral Pathol* 1967;**24**:164–70.
8. Shi D, Patil PM, Gupta R. Facial nerve injuries associated with the retromandibular transparotid approach for reduction and fi xation of mandibular condyle fractures. *J Craniomaxillofac Surg* 2015;**43**:402–7.
9. Wilson AW, Ethunandan M, Brennan PA. Transmasseteric antero-parotid approach for open reduction and internal fixation of condylar fractures. *Br J Oral Maxillofac Surg* 2005;**43**:57–60.
10. Kim BK, Kwon YD, Ohe JY, et al. Usefulness of the retromandibular transparotid approach for condylar neck and condylar base fractures. *J Craniofac Surg* 2012;**23**:712–5.
11. Al-Moraissi EA, Louvrier A, Colletti G, et al. Does the surgical approach for treating mandibular condylar fractures affect the rate of seventh cranial nerve injuries? A systematic review and meta-analysis based on a new classification for surgical approaches. *J Craniomaxillofac Surg* 2018;**46**:398–412.
12. Loukota RA, Eckelt U, De Bont L, et al. Subclassification of fractures of the condylar process of the mandible. *Br J Oral Maxillofac Surg* 2005;**43**:72–3.
13. Kempers KG, Quinn PD, Silverstein K. Surgical approaches to mandibular condylar fractures: a review. *J Craniomaxillofac Trauma* 1999;**5**:25–30.
14. Ellis E, Throckmorton GS. Treatment of mandibular condylar process fractures: biological considerations. *J Oral Maxillofac Surg* 2005;**63**:115–34.
15. Hwang NH, Lee YH, You HJ, et al. Endoscope-assisted transoral fixation of mandibular condyle fractures: submandibular versus transoral endoscopic approach. *J Craniofac Surg* 2016;**27**:1170–4.
16. Ellis 3rd E, Dean J. Rigid fixation of mandibular condyle fractures. *Oral Surg Oral Med Oral Pathol* 1993;**76**:6–15.
17. Narayanan V, Ramadorai A, Ravi P, et al. Transmasseteric anterior parotid approach for condylar fractures: experience of 129 cases. *Br J Oral Maxillofac Surg* 2012;**50**:420–4.

18. Salgarelli AC, Anesi A, Bellini P, et al. How to improve retromandibular transmasseteric anteroparotid approach for mandibular condylar fractures: our clinical experience. *Int J Oral Maxillofac Surg* 2013;**42**:464–9.
19. Tang W, Gao C, Long J, et al. Application of modified retromandibular approach indirectly from the anterior edge of the parotid gland in the surgical treatment of condylar fracture. *J Oral Maxillofac Surg* 2009;**67**:552–8.
20. Downie JJ, Devlin MF, Carton AT, et al. Prospective study of morbidity associated with open reduction and internal fixation of the fractured condyle by the transparotid approach. *Br J Oral Maxillofac Surg* 2009;**47**:370–3.
21. Gosain AK. Surgical anatomy of the facial nerve. *Clin Plast Surg* 1995;**22**:241–51.
22. Kanno T, Sukegawa S, Tatsumi H, et al. Does a retromandibular transparotid approach for the open treatment of condylar fractures result in facial nerve injury? *J Oral Maxillofac Surg* 2016;**74**:2019–32.