Review Article

Post-traumatic superolateral dislocation of condyle: A case series of 18 condyles with review of literature and a proposed classification.

Dichen Palmo Bhutia*, Divya Mehrotra, Nitin Mahajan, Debraj Howlader, Jagdish Gamit

Dept. Oral and Maxillofacial Surgery, King George's Medical University, Lucknow, India

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ABSTRACT

Aim: The aim is to review the English literature for post-traumatic superolateral dislocation of mandibular condyle (SDMC), discuss their dynamics and clinical management and to propose to modify the existing classification of SDMC. **Patients and Methods:** A literature search was carried at Pubmed, Sciencedirect, Google and references from reported articles were crosschecked to look for the cases of SDMC from 1969 to 2015 in English language. Also, we have reviewed 11 of our patients with total of 18 superolateral dislocated intact or sagittal split condyles, who visited our unit in the previous two years. **Results:** In our retrospective analysis 58 cases of SDMC were found in the literature, of which 38 had intact mandibular condyles and 20 had sagittal split. Early and intact SDMC were successfully managed conservatively with closed reduction, whereas old cases and largely fractured condyles necessitated open reduction. Additionally, we observed an unusual dislocation associated with fracture of contralateral posterior mandible (angle) in our series which did not gratify the existing classification. **Conclusion:** Alteration of the existing classification was required to accommodate the unusual type of dislocation.

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1. Introduction

By definition Temporomandibular joint (TMJ) dislocation involves a non self limiting displacement of the condyle, outside of its functional position within the glenoid fossa and the posterior slope of articular eminence.¹ Dislocation of TMJ represents 3% of all reported dislocated joints.² Depending on its direction of dislocation, it is classified as anterior, posterior, lateral or superior.³

Dislocation of condyle was classified by Allen⁴ as Type I (lateral subluxation) and Type II (complete dislocation) in which the condyle is forced laterally and superiorly to enter the temporal fossa. In the latter situation the medial end of the ovoid-shaped head of the condyle is engaged above the posterior root of the zygomatic arch. Satho et al.⁵ further classified type II into 3 subtypes i.e. type IIA, in which the condyle is not hooked above the zygomatic arch; type IIB, in which the condyle is hooked above the zygomatic arch; and type IIC, in which the condyle is lodged inside the zygomatic arch, which is fractured. Truro et al added a type III dislocation as a complete dislocation without associated fracture of anterior mandible.⁶

* Corresponding author.

E-mail addresses: dichen.namchang@gmail.com (D.P. Bhutia), divyamehrotra@gmail.com (D. Mehrotra), drnitinmhjn@gmail.com (N. Mahajan), drdebrajhowlader@gmail.com (D. Howlader), drjagdish4you@gmail.com (J. Gamit).

Table 1

Reported Superolateral dislocation of maandibular condyles from 1969–2015.

S N	Year	Authors	Age (yrs)	Sex	Etiology	No of Condyles	Intact/ sag #	Type	Side	Reduction after Days	Reductin Condyle	Assoc mand #	MO	Follow up
1.	1969	Allen ⁴	16	M	RTA	5	Intact	I	R	8	C	sym,	NA	Fibro-osseous ankylosis
2.			50	M	RTA		Intact	II	L	15	C	Rt body	NA	Malocclusion
3.			36	M	RTA		Intact	I	B	1	C	Lt Parasym	NA	Malocclusion
4.			22	M	RTA		Intact	I	L	1	C	Sym	NA	
5.			30	M	RTA		Intact	II	R	1	C	L Parasym	NA	Not available
6.	1978	Brusati Paimi ⁸	NA	NA	NA	2	Intact	II	U	1	C	None	NA	facial palsy
7.			NA	NA	NA		Intact	II	U	12	O	None	NA	facial palsy
8.	1982	Worthington ²¹	NA	NA	NA	1	Intact	Unusual	U	14	O	Contralat	NA	For management of Fibro-osseous ankylois
9.	1988	Devita ⁹	28	F	RTA	1	Intact	II	B	NA	C	None	NA	Coronoidectomy for limited MO
10.	1989	Ferguson ¹¹	31	M	Bull	1	Intact	II	U	1	O	Midline	30	For arthroplasty
11.	1989	To ¹²	34	M	Fall	1	I	II	R	14	O	Sym,	17	Preauricular incision for reduction
12.	1994	Satoh ⁵	NA	NA	NA	1	Intact	II	B	13	O	NA	30	Interposition Arthroplasty
13.	1996	Kapila ³	42	M	RTA	1	Intact	II	L	7	C	Sym,	30	
14.	1998	Hoard ¹³	NA	NA	NA	1	Intact	II	B	NA	O	NA	NA	
15.	2000	Yoshii ²¹	1.5	F	RTA	1 Ant	Intact	II	B	16	O	Sym, ZA	20	Preauricular for reduction
16.	2002	Rattan ¹⁴	55	M	RTA	2	Sag #	II	R	14	O	midline	30	Preauricular for removal of medial fragment
17.			52	M	RTA		Intact	II	B	21	O	midline	35	Preauricular, bilateral Interposition Arthroplasty, bilateral Coronoidectomy manual
18.	2007	Hsieh ²¹	23	M	RTA	1	Intact	II	B	1	C	midline	41	
19.	2007	Bu ¹⁵	42	M	RTA	1	Intact	II	L	5	C	none	37	
20.	2009	Lloyd ²¹	20	M	RTA	1	Intact	Unusual	L	NA	O	R angle	30	Open reduction, craniotomy
21.	2010	Papadopoulos ²¹	16	M	RTA	1	Intact	II	B	NA	O	none	32	Coronoidectomy
22.	2010	Vasconcelos ²¹	30	M	RTA	1 Post	Intact	Unusual	L	NA	C	none	NA	Percutaneous hook sigmoid
23.	2010	Hegde ²¹	32	M	RTA	1	Intact	II	U	5	O	none	NA	Preauricular incision for reduction
24.	2010	Tauro ⁶	25	M	RTA	1	Intact	II	B	3	C	Midline	35	Manual reduction under sedation
25.	2011	Christiano et al ²¹	03	F	RTA	1	Sag #	II	NA	1	C	none	NA	Normal occlusion & TMJ function
26.	2011	Prabhakar ²¹	47	F	Fall	1	Intact	II	B	45	O	none	30	preauricular for reduction
27.	2011	Amaral ¹⁶	15	F	RTA	1	Intact	II	L	NA	C	Symphysis, panfacial	30	
28.	2011	Imai ¹⁷	23	M	RTA	1 Ant	Intact	II	R	11	O	Zygomatic complex, articular eminence	45	Preauricular for reduction, fixation of arch, removal of fragments
29.	2013	Kim ¹⁸	54	M	RTA	1	Intact	II	B	1	C	midline	NA	Percutaneous traction at sigmoid, FRM
30.	2013	Radhakrishna ¹⁹	50	M	RTA	1	Intact	II	L	NA	C	Rt body	NA	Open Traction, FRM
31.	2013	Singh ²⁰	22	M	RTA	1	Intact	II	B	2	O	Lt parasym	33	R submandibular for traction at angle & sigmoid, L manual
32.	2013	Saraswathi ²⁰	8	F	Fall	1	Intact	IIB	L	NA	C	-	35	
33.	2013	Shen ²¹	40	M	RTA	10	Intact	IIB	L	4	C	midline	34	
34.			20	M	RTA		Intact	IIB	B	12	O	midline	33	Sagittal split osteotomy
35.			44	M	RTA		Sag #	IIB	L	15	O	midline	30	Sagittal split osteotomy
36.			32	M	RTA		Intact	IIA	R	17	O	midline	37	Sagittal split osteotomy
37.			20	M	RTA		Intact	IIA	R	5	C	Rt angle	41	
38.			16	M	RTA		Sag #	IIA	B	12	O	midline	38	Sagittal split osteotomy
39.			58	M	Fall		Intact	IIB	R	6	C	midline	34	
40.			27	M	RTA		Intact	IIA	L	27	O	midline	36	Sagittal split osteotomy
41.			46	M	RTA		Sag #	IIB	L	19	O	midline	38	Sagittal split osteotomy
42.			39	M	RTA		Intact	II B	B	35	O	midline	27	Sagittal split osteotomy
43.	2013	Chaitanya ²²	4	F	Fall	1 Ant	Intact	II C	U	6	O	none	30	Preauricular incision for reduction
44.	2013	Li ²³	28	M	RTA	13	Sag#	3 II B	U	NA	C	none	39	
45.			31	M	RTA		Sag#		U	NA	O	midline	38	Reduction fixation & Disc repair
46.			19	M	RTA		Sag#		U	NA	O	midline	36	Reduction fixation & Disc repair
47.			42	M	RTA		Sag#		U	NA	O	midline	34	Reduction fixation & Disc repair
48.			36	M	RTA		Sag#		U	NA	O	---	39	Reduction fixation & Disc repair
49.			19	F	RTA		Sag#		U	NA	O	midline	36	Reduction fixation & Disc repair
50.			25	M	RTA		Sag#		U	NA	O	body	34	Reduction fixation & Disc repair
51.			22	M	RTA		Sag#		U	NA	O	midline	35	Reduction fixation & Disc repair
52.			18	M	RTA		Sag#		U	NA	O	--	40	

Table 1 (Continued)

S N	Year	Authors	Age (yrs)	Sex	Etiology	No of Condyles	Intact/sag #	Type	Side	Reduction after Days	Reductin Condyle	Assoc mand #	MO	Follow up
53.			36	F	Fall		Sag#		U	NA	O	body	36	Reduction fixation & Disc repair
54.			43	M	Fall		Sag#		B	NA	O	midline, body	33	Reduction fixation & Disc repair
55.			18	M	RTA		Sag#		B	NA	O	midline	28	Reduction fixation & Disc repair
56.			45	M	RTA		Sag #		B	NA	O	midline	35	Reduction fixation & Disc repair
57.	2014	Özalp ²⁴	17	F	RTA	1 Ant	Intact	II C	L	33	O	Mandible		Temporalis muscle divided open bite deformity laterognathism at 6 months
58.	2015	Rehman ²⁵	55	M	RTA	1	Sag #	II B	L	6	C	–		

NA. not available, RTA- road traffic accident, L- left, R-right, B- bilateral, sag#-sagittal split fracture, C- closed reduction, O- open reduction, MO-mouth opening.

B-Bilateral, R-right,L-Left, I-intact,sag #-sagittal split,C-manual reduction, T-traction at angle with wire, Cor- coronoidectomy,

ORIF-open reduction and internal rigid fixation, FRM- full range of motion, Moc-malocclusion, F-female, M- male.

Such TMJ dislocations are usually overlooked and pose a challenge in the diagnosis, management and achievement of occlusion. The purpose of this study was to list the cases of SDMC reported, discuss their types, clinical management and put forward a proposal of modifying the existing classification of SDMC.

2. Patients and Methods

A literature search was carried at Pubmed, Sciencedirect, Google and references from reported articles were crosschecked to look for cases of superolateral dislocation of mandibular condyle from 1969 to 2015, but reported only in English language.

All patients visiting our department of oral and maxillofacial surgery and diagnosed as case of SDMC, with or without other associated maxillofacial fractures, in a two years period from June 2013–Aug 2015 were retrospectively included in the study after obtaining their informed consent. The study was duly approved by the Institutional Research Cell.

The data collected from the patients included age, gender, type of trauma, side of condylar involvement, status of dislocated condyle i.e. intact or sagittal split, type of dislocation,⁵ associated other mandibular or mid- facial fractures, method of reduction of condyle, treatment procedure, outcome, follow up period, and maximal inter incisal mouth opening at the last followup. Radiographic assessment was done using posteroanterior view mandible, orthopantomogram and computerised tomograms with 3D reconstruction at different follow up intervals. The follow up period ranged from 3 to 24 months (mean 19.6 months) wherein post operative assessment of patients was conducted.

3. Results

In our literature review, 58 cases of SDMC were collected from the reported English scientific literature from 1969 to 2015 (Table 1). Among these, 38 (65%) included intact mandibular condyle and the remaining 20 had sagittal split (35%), with or without associated mandibular fractures. The dislocations were mostly unilateral (68%), while remaining (32%) were bilateral. The average age was 30.33 (range 3–55 years). Among these, 81% were males, and 19% females. Road traffic accidents (87%) were the most common aetiology, followed by fall (13%). About 70% of the dislocations were associated with pure mandibular fractures while approximately 18% had other associated facial bone fractures. In the remaining 12%, mandible as well as the midface were intact.

Type II unilateral dislocation was the most common (90%), whereas type I was observed in 5%. The remaining 5% constituted of other unusual types, that did not fit into the existing classification, suggesting a need to modify the same (Figs. 1–4).

Therefore, we propose to upgrade the existing classification to include such types of dislocations

Type I—Lateral subluxation

Type II—Complete dislocation with associated fracture of anterior mandible

Type IIA—Condyle not hooked above the zygomatic arch

Type IIB—Condyle hooked above the zygomatic arch

Type IIC—Condyle lodged within the zygomatic arch which is fractured

Type III—Complete dislocation with associated fracture of posterior mandible

Type IIIA—Condyle not hooked above the zygomatic arch

Type IIIB—Condyle hooked above the zygomatic arch

Type IIIC—Condyle lodged within the zygomatic arch which is fractured

Type IV- Complete dislocation without any associated fracture of mandible

The mean reduction time reported in the literature was 11 days. Closed reduction methods like inferior mandibular retraction through wire pull at angle or a hook placed at sigmoid notch, posterior mouth props etc. were used to reduce the dislocated condyles in 40% whereas open reduction was performed in 60%.

Among our 18 cases of SDMC reported here, 7 (64%) were bilateral, 3 (27%) left and 1 (9%) right condyle. 12 condyles were intact (67%) while 6 (33%) had sagittal fracture. 12 condyles (67%) belonged to type IIA dislocation, 2 (11%) condyles each to type IIB, type IIC and type I dislocation. All cases had a history of trauma due to road traffic accident, except one with the history of fall from height. Parasymphyseal fracture was the most common associated mandibular fracture (46%), followed by fracture in the body (30%), coronoid (15%) and angle (7%). Among the fractures of mid-face, we observed that zygomatic complex was fractured in 4 cases (57%) and LeFort II in 3 cases (43%). 12 condyles (67%) underwent reduction within less than 7 days after dislocation (fresh cases) while in the other 6 cases (34%) reduction was performed at more than seven days, but all within 13 days. (Table 2)

Although few of the cases had limited Range of Motion of mandible with one case of limited mouth opening (28 mm), overall jaw functions were satisfactory. The followup period ranged from 3 to 24 months. (Table 2)

Fig. 1. PA view showing Left SDMC with fracture contra lateral angle.

Fig. 3. 3D Reconstructed frontal view of left SDMC with fracture right angle..

Fig. 2. Coronal CT showing left SDMC with fracture right angle.

Fig. 4. PA view showing angle fixation and reduced condyle.

Table 2
Superolateral dislocation of mandibular condyle in 11 patients (18 condyles).

Sn		Age/ sex	Side	I/ sag #	Type	Assoc Mandibular fracture	Asso Facial fracture	Reduction of SDMC	Treatment of other fractures.	Reduction time (Days)	MMO (mm)	Follow up (Month)	Outcome
1		40/M	L	I	II A	R angle	None	C	ORIF	3	35	13	FRM
2		32/M	B	I	Right II B	L para	B L LFII,	C	ORIF	5	35	24	FRM
3		11/F	B	I	II A	L body	None	C	ORIF	5	30	7	FRM
4		35/M	R	I	II A	L body	None	C	Cor ORIF	9	42	3	FRM
5		30/M	L	I	II C	L para	B ZMC	C+T	ORIF	4	40	5	FRM
6		32/M	B	I	II A	R para	B LFII	C+T	ORIF	9	36	3	75%RM
7		60/M	B	I	Right I	R para	B LF-II.	C+T	ORIF	9	30	5	75%RM
8		28/M	B	R#, LI	Right I	L para	None	C+T	ORIF	7	32	6	FRM
9		30/M	B	Sag #	II A	R coronoid,	B ZMC	C+T	Cor R, ORIF	6	30	6	75%RM

Table 2 (Continued)

Sn	Age/ sex	Side	I/ sag #	Type	Assoc Mandibular fracture	Asso Facial fracture	Reduction of SDMC	Treatment of other fractures.	Reduction time (Days)	MMO (mm)	Follow up (Month)	Outcome
10	43/F	B	Sag #	Right II A	L paras	None	C + T	ORIF	7	30	6	FRM

11	11/F	L	Sag #	II A	L body	None	C	ORIF	12	28	4	75% RM

Total	Mean 32	7B	12Intact, 6 sag #	14 –II A, 2 –II B,	6 parasym, 4 body,	3 ZMC,	C –7	ORIF-11	Mean –7 days	Mean –34 mm	Mean- 7.4	

4. Discussion

Superolateral dislocation of the intact mandibular condyle is a very rare condition. It was first reported by Robert in 1849. Later, Allen⁴ observed associated fracture of anterior mandible, near the symphysis with superolateral dislocation of condyle. Li et al presented a series of thirteen patients and demonstrated sagittal splits in CT scan images of dislocated condyles.²³

Till date, there are only 38 well-documented cases of superolateral dislocation of intact mandibular condyles and 20 sagittal split condyles dislocated superolaterally. Most of these cases presented with associated symphyseal or parasymphyseal fractures. If we look at the possible justification for condylar dislocation superolaterally, certain factors such as direction and amount of impact, the position of jaw during impact (wide open) along with anatomical features of the joint and the surrounding muscles need to be favorable to push the condyle laterally and then superiorly.^{6,7} We postulate, that if a high energy force is applied to the anterior mandible that would cause the mandible to fracture and open outwardly, it would dislocate the intact condyle laterally above the zygomatic arch. However, if the force pushes the mandible superolaterally the impact would cause sagittal split of the condyle, dislocating it superiorly.

According to Allen and Young⁴ fracture of the anterior mandible near the symphysis is a prerequisite for a Type II dislocation as it facilitates rotation and movement of ramus outward and laterally resulting in SDMC. However, in one of our case, a type II A dislocation of mandibular condyle was associated with a mandibular angle fracture of the contralateral side.

Li et al also reported one case of type II dislocation where symphysis, body and condylar head were intact but had an associated ipsilateral angle fracture. Based on the literature search, we were unable to find a case similar to ours with contralateral angle fracture. Therefore, we draw a conclusion that apart from fracture at symphysis and body of mandible, even a fracture at contralateral angle of mandible can lead to SDMC.

The goal of the treatment for SDMC is to reposition the condyle into its original physiological position and closed reduction is first choice of treatment as it is the simplest, least traumatic and safest if managed early.^{9,15,16} Maximal inter incisal mouth opening of 30 mm and good occlusal relationship 5 months post operatively is regarded as good sign of successful treatment of condylar dislocation.¹⁶ SDMC in all of our cases were corrected by closed

or manual reduction under general anesthesia. 7 condyles (39%), from the fresh cases were successfully reduced with outward manual pressure on the ascending ramus and downward traction of the condyle. Inferior traction of the ipsilateral angle with the help of 24 gauge stainless steel wire passed through a hole drilled in the exposed angle region were done in other 11 (61%) cases. Inter-maxillary fixation was recommended for 2 weeks postoperatively in all these patients followed by immediate extensive physiotherapy.

Both closed and open reduction of superolateral dislocated condyles is challenging due to traction effects of masticatory muscles. Adjunct medication like Diazepam for sedation and intraarticular infiltration of local anaesthesia may be required to overcome the spasm of lateral pterygoid muscle. Additionally, general anaesthesia and muscle relaxants may be used.

Ferguson¹¹ and Kapila¹ described traction through wires placed in holes drilled in the exposed angle region nerve. Temiz¹⁰ reported use of Muselet technique for reduction of six laterally dislocated condyles, associated with symphyseal or parasymphysial fractures.

In our series too, we attempted manual reduction using traction at the posterior occlusal plane using rubber stoppers and intermaxillary fixation for 2–3 days, but were unsuccessful. The reduction was then successfully achieved by manual reduction and wire pull on operating table.

Sagittal split of the mandibular condyle can be easily missed on radiographs and may either remain in the glenoid fossa or occasionally get pulled in an anteromedial direction causing mechanical obstruction and thereby constraining normal jaw function.^{23,14} Incidences of bifid condyles and TMJ ankylosis are associated with traumatic condylar dislocations and hence should be considered as an important entity.^{4,5,12,15}

Facial nerve damage may occur if the degree of displacement causing its traction is more than its anatomical limit, thereby resulting in variable degrees of neurological complication.^{4,6,8}

Studies suggest that there is tendency of the manually reduced condyles to revert to the pre-operative position.¹⁵ Therefore, all patients in our series were kept under intermaxillary fixation following reduction, for 2 weeks, followed by rigorous mouth-opening exercise. Additionally, it facilitates healing of presumably damaged joint capsules and ligaments.

Devita¹⁰ and Rattan¹⁴ had to carry out intraoral coronoidectomy to facilitate reduction of the condyles. We performed

intraoral coronoidectomy in two of our cases, one with and another without associated coronoid fracture, to overcome mechanical obstruction during the condylar reduction.

Two cases in our series were female pediatric patients, one with bilateral intact condylar dislocation and other with left dislocation along with sagittal split of involved condyle. They underwent open reduction and internal fixation for the associated mandibular fracture and closed reduction for the condyles with angular traction followed by IMF for 10 days. Since the fragment was small and intracapsular, it did not necessitate removal or fixation and was therefore left in situ. Post-op results were satisfactory at 3 months followup showing a mouth opening of 30 mm and proper jaw function in one, and 28 mm in other but with slight occlusal discrepancy. Both were advised for a long term follow up and active physiotherapy. The follow up results showed a good functional range of mandibular movement in almost all the cases.

5. Conclusion

Superolateral dislocation of intact condyles can be successfully managed conservatively with manual reduction, if treated early. Surgery is required only for removal or fixation of moderate to large sagittal split fragments of condyle. Further, modification is required in the classification to accommodate unusual types of SDMC.

Conflict of Interest

None.

Ethics statement/patient

Ethical approval received. Written consent obtained.

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