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Superolateral extracapsular dislocation of the mandibular condyle: Review of the literature and report of two cases

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ABSTRACT

Trauma to the temporomandibular joint may cause one of several injuries amongst which is the dislocation of the mandibular condyle. Several aetiological factors result in condylar dislocation, and although there are global variations, road traffic accidents and falls feature prominently, followed by interpersonal violence.

Dislocated fractures result in displacement of the condylar head out of the glenoid fossa. The condylar head may be dislocated anteriorly, posteriorly, medially, laterally or superiorly.

Lateral dislocation of condylar head is very rare, and is regarded as an absolute indication for open reduction and internal fixation of the fractured condyle to relocate the condylar head into the fossa, to restore altered joint mechanics and to correct the resultant malocclusion. We review the literature on superolateral dislocation of the mandibular condyle and report on two cases of delayed presentation and their management.

1. Introduction

Dislocation of the mandibular condyle of the temporomandibular joint (TMJ) is defined as a clinical condition in which the head of the condyle is displaced out of its functional position within the glenoid fossa and posterior slope of the articular eminence while it still remains within the capsule of the joint [1–6]. It is a non-self-limiting condition [3–5]. In the fifth century BC, Hippocrates first described a dislocation and its reduction, a method that is still used today [7]. Subluxation, an incomplete dislocation, occurs when the articular surfaces of the condylar head and glenoid fossa maintain partial contact and the condyle can return to the glenoid fossa by self-manipulation or voluntarily while luxation is a complete dislocation [7].

Dislocations can be acute or chronic [7] and can be classified based on the direction of displacement as anterior, posterior, superior, medial or lateral [1–3,5–14]. Dislocations in the anterior and anteromedial directions are most common due to forces caused by the action of the lateral pterygoid muscle [4,6,7,14–20]. Dislocations in the posterior, superior and lateral directions are rare and may be associated with fractures of the mandible and/or adjacent bones [1,2,6,7,9,11,15,17–23]. Even rarer is dislocation superolaterally of an intact condyle [1,2,5,6,8,10,11,22,24]. This rarity is due to a number of factors such as the varying anatomy of the condyle, the direction of pull of muscles and ligaments attached to the condyle as well as the capsule [6,14,18]. The biomechanics of the slender neck of the condyle act as a safety mechanism when a high-impact force is exerted on the condylar region as the neck of the condyle fractures (before a dislocation can occur) dissipating the applied energy and contributing to the rarity of superolateral dislocations [6,11,12].

We report on two cases of traumatic superolateral dislocations of intact mandibular condyles associated with panfacial fractures. Review of the literature of similar cases is also undertaken in an attempt to understand the dynamics of aetiology, pattern, diagnosis and

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current methods of treatment of such dislocations.

2. Case report one

A 24-year old male presented to the Out Patients Department Clinic of the Department of Maxillofacial and Oral Surgery, Chris Hani Baragwanath Academic Hospital, complaining of facial deformity and inability to eat 56 days after being involved in a motor vehicle accident. He was an unrestrained passenger in a minibus from which he was ejected at the point of impact. He reported loss of consciousness for approximately 10 minutes. He only sustained maxillofacial injuries.

Clinical examination showed pronounced facial asymmetry with deviation of the mandible towards the left side. He had paraesthesia bilaterally in the distribution of the mental nerve. Bony steps were palpable on his left zygoma at the frontozygomatic suture area, right zygomatic arch and right mandibular angle and a bony protuberance was palpable on the lateral aspect of his left zygomatic arch.

Intra-oral examination revealed limited mouth opening with an inter-incisal distance of 5 mm, a shift in the mandibular midline towards his left side and deranged occlusion with bilateral crossbites (Fig. 1).

An orthopantomogram, posterior anterior radiograph of the mandible and computed tomography (CT) scans taken in the coronal, sagittal and axial planes showed that the left condyle was dislocated laterally and hooked over the zygomatic arch (Fig. 2). In addition he had sustained a Le Fort III fracture, right hemimaxillary fracture and a fracture of the right angle of his mandible. The right condyle was intact within the glenoid fossa.

Fifty seven days after the injury, under general anaesthesia via a naso-endotracheal intubation, maxillary and mandibular Erich archbars were placed. Surgical exposure of the left temporomandibular joint was performed via an Al Khayat and Bramley preauricular incision. The left condylar head was found hooked lateral and over the root of the left zygomatic arch (which was fractured at the root) (Fig. 3). The condyle was manipulated and relocated into the glenoid fossa by applying downward traction with a blunt heavy periosteal elevator. Open reduction and internal fixation of the left zygoma (fronto-zygomatic suture, left zygomatic arch), right hemimaxillary fracture and right angle was performed after osteotomy of these fractured segments (Fig. 4). The patient's mouth opening improved and the occlusion was restored (see Fig. 5).

The patient was placed into intermaxillary fixation (IMF) using the Erich arch bars and 26 gauge wires, and the IMF was maintained for two weeks. Post-operatively the patient had weakness of the frontal branch of the facial nerve. Two weeks post-operatively the IMF was released and replaced by guiding elastics for 4 weeks. Intense jaw physiotherapy using wooden tongue depressors was simultaneously initiated. The post-operative course was uneventful and full recovery of the frontal branch of the facial nerve was noticed 8 weeks post-operatively. Twelve months after the reduction his maximum incisal opening was 20 mm and his occlusion was intact.

3. Case report two

A 27-year old male presented to the Out Patients Department Clinic of the Department of Maxillofacial and Oral Surgery, Charlotte Maxeke Johannesburg Academic Hospital, complaining of facial deformity and progressively decreasing mouth opening 73 days after being involved in a motor vehicle accident. He was a back-seat unrestrained passenger in a car. He reported loss of consciousness for an unspecified period of time. He also sustained cervical vertebrae, rib and tibial fractures. He had undergone open reduction and internal fixation of his tibial fracture 7 days after the injury.

Clinical examination showed a bony hard projection/prominence in the left preauricular area, tenderness of the right temporomandibular joint on maximal opening and healed scars from the left angle to zone II of the neck and in the submental fold.

Intra-oral examination revealed limited mouth opening with an inter-incisal distance of 15 mm and an intact occlusion.

An orthopantomogram and computed tomography scans taken in the coronal, sagittal and axial planes showed a subcondylar fracture of the left condyle that was dislocated laterally and unhooked over the zygomatic arch (Fig. 6).

Fig. 1. (a) Pronounced facial asymmetry with deviation of mandible towards the left. (b) Deranged occlusion with crossbite.

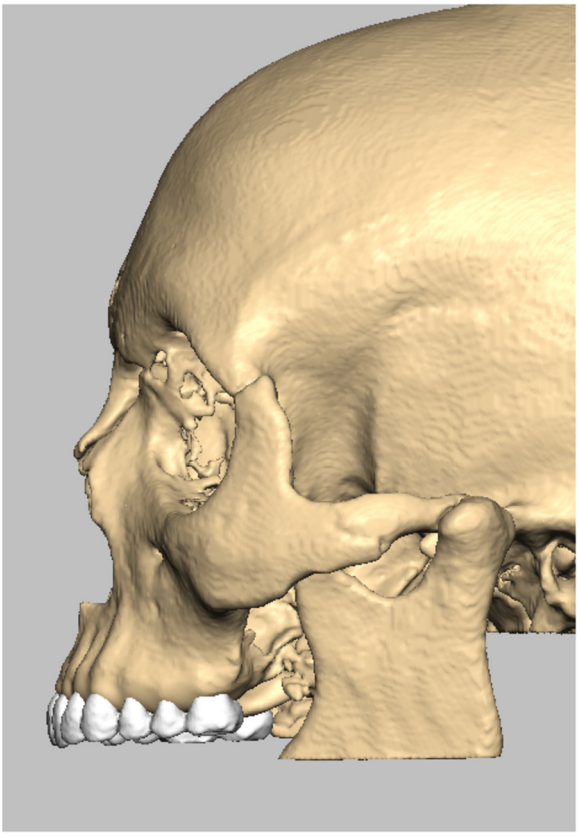

Fig. 2. Preoperative CT scan showing laterally dislocated left condyle hooked over zygomatic arch.

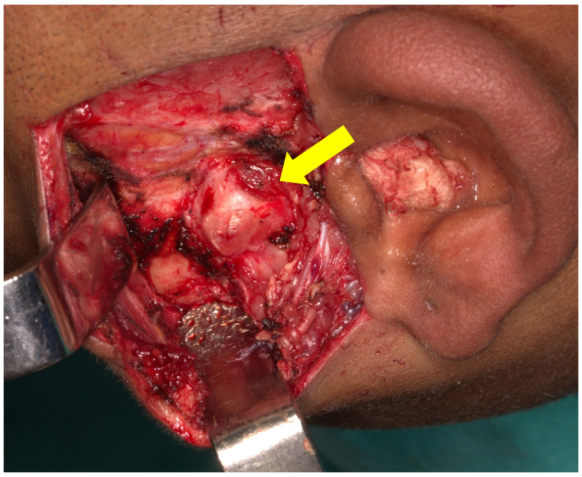

Fig. 3. Pre-reduction intra-operative view of laterally dislocated left condyle hooked over zygomatic arch.

Seventy four days after injury, under general anaesthesia via a naso-endotracheal intubation, maxillary and mandibular Erich archbars were placed. Surgical exposure of the left temporomandibular joint was performed via an Al Khayat and Bramley preauricular incision. The left condylar head was found hooked lateral to the root of the left zygomatic arch (Fig. 7). The left subcondylar fracture was osteotomized. The condyle was manipulated and relocated into the glenoid fossa by applying downward traction. Open reduction and internal fixation of the left subcondylar fracture was performed (Fig. 8) (see Fig. 9).

The patient was placed into IMF using the Erich arch bars and 26 gauge wires, and the IMF was maintained for two weeks. Two weeks post-operatively the IMF was released and replaced by guiding elastics for 4 weeks. Intense jaw physiotherapy using wooden tongue

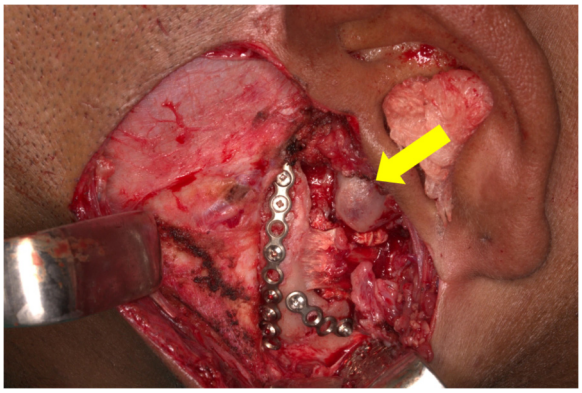

Fig. 4. Intra-operative view of left condyle reduced into glenoid fossa and open reduction internal fixation of zygomatic arch.

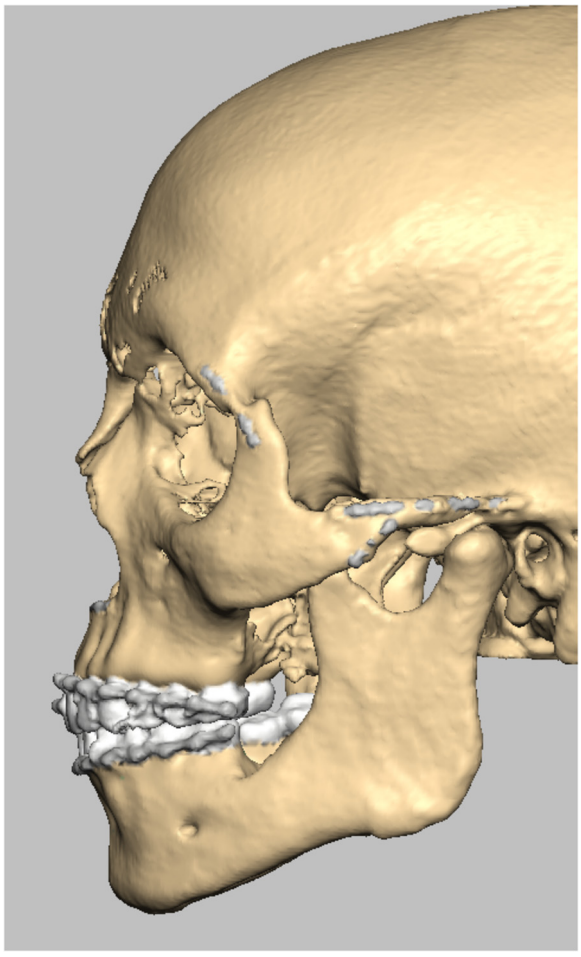

Fig. 5. Post-operative CT scan confirming correct position of left condyle.

depressors was simultaneously initiated. The post-operative course was uneventful. Seven months after the reduction his maximum incisal opening was 30 mm and his occlusion was intact.

4. Discussion

In 1969 Allen and Young [12] described the first cases of superolaterally displaced mandibular condyles and classified them into

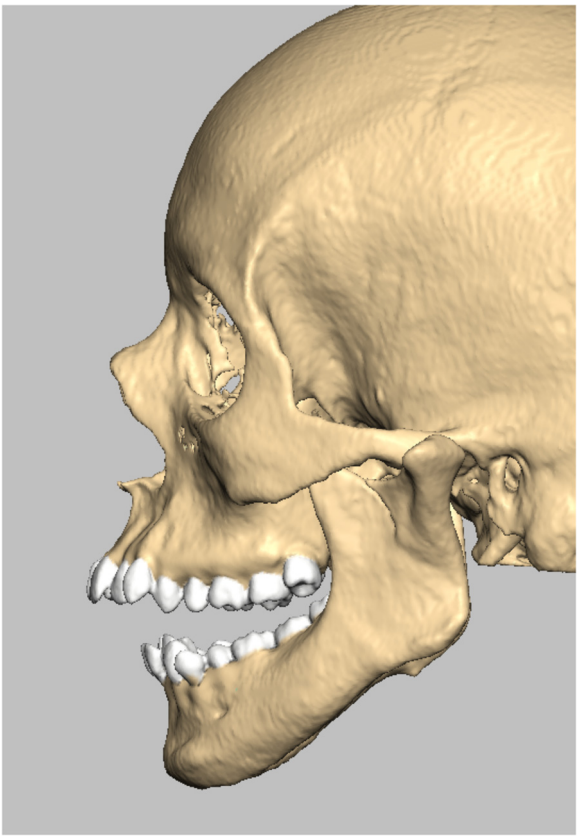

Fig. 6. Preoperative CT scan showing laterally dislocated left condyle unhooked over zygomatic arch with subcondylar fracture.

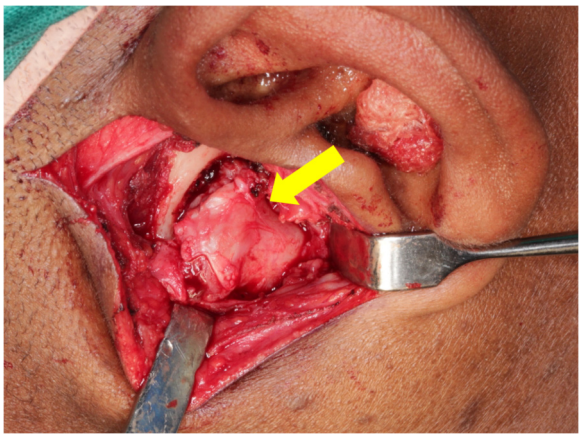

Fig. 7. Pre-reduction intra-operative view of laterally dislocated left condyle unhooked over zygomatic arch.

Type I (lateral subluxation), in which the displacement of the condyle occurs laterally out of the glenoid fossa, and Type II (complete dislocation), where the condyle is displaced laterally and then superiorly into the temporal fossa [1–18,22–29]. In 1994 Satoh et al. [23] proposed a modification of the classification and subtyped Type II dislocations into Type IIA in which the condyle is unhooked over the zygomatic arch, Type IIB where the condyle is hooked above the zygomatic arch and Type IIC where the condyle is lodged inside the zygomatic arch which is fractured [1–10,13–18,22–28]. A fracture of the anterior mandible was initially considered a prerequisite for a Type II dislocation [2,4,5,11–15,18,22,23]. However, superolateral dislocations have been described with no associated fractures of the mandible [3,4,9,13,14,17,22] or with a fracture of the contralateral angle [5]. These classifications did not account for superolateral dislocations in the absence of fractures of the mandible. As a result Tauro et [18] al proposed a modification of the classification where Type II dislocations were designated as complete dislocations with associated fractures of the anterior mandible and Type III dislocations

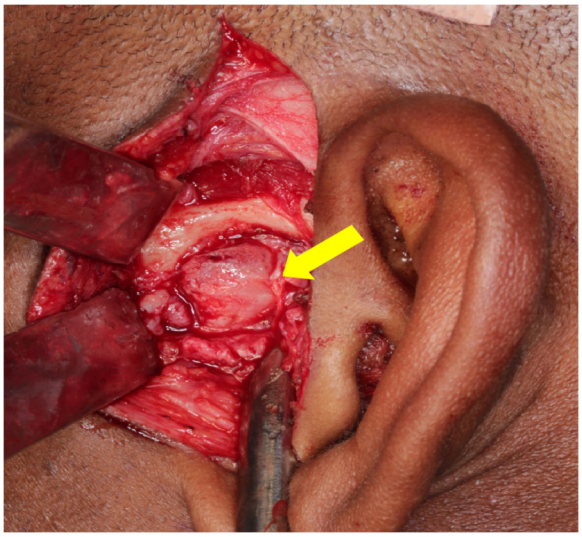

Fig. 8. Intra-operative view of left condyle reduced into glenoid fossa.

Fig. 9. Post-operative PA mandible radiograph confirming correct position of left condyle.

were added as complete dislocations without associated fractures of the anterior mandible [4–6,14,17,18](Fig. 10). Both Type II and Type III dislocations had the same subcategories of Satoh et al. [23]. Further modifications have been proposed by Malik et al. [17], Bhutia et al. [5] and Prabhakar et al. [13]. According to these classifications our first case belongs to the Type IIB dislocation and our second case belongs to the Type IIA dislocation.

A Pubmed and Science Direct search of the English scientific literature found 31 publications with 55 cases of superolateral dislocation of intact mandibular condyles from 1969 to 2018 using the key words "Superolateral dislocation condyle" (Table 1). Reported superolateral dislocations of intact mandibular condyles have a mean age of 30.2 years and a male predilection with a female to male prevalence ratio of 1:4.6. Most result from road traffic accidents (RTA) (83.6%) followed by a fall (16.4%). 60% of the cases sustained unilateral dislocations while the remainder (40%) reported bilateral dislocations. Type II unilateral dislocations were the most common (81.6%), while Type I dislocations account for 18.4%. 65.5% of dislocations were associated with isolated mandibular fractures while 12.7% had pan facial fractures. In the remaining 21.8% the midface as well as the mandible was intact.

Li et al. [9] explained the dynamics of superolateral dislocations and concluded that for this injury to occur the size and direction of the applied force, the position of the jaw during the application of the force (wide open mouth) and the anatomic features of the joint (joint capsule and pterygoid muscles) are critical [4–6,9,10,14,17,18]. Therefore, if the patient's mouth is open at the time of impact, the condyle is located outside the glenoid fossa and in an unstable position anterior to the articular eminence. In this position extreme

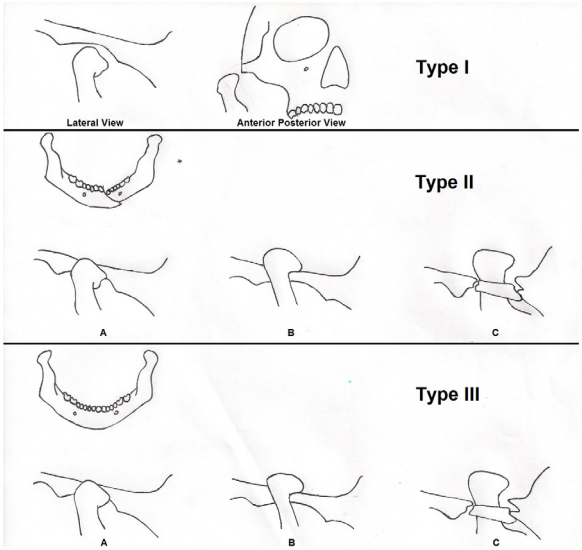

Fig. 10. Classification of superolaterally displaced mandibular condyles (Modified from Satoh et al. [23]).

movement is only limited by the temporomandibular ligament with no comparable ligament on the medial aspect of the condyle. A force applied to the side of the mandible in this position could displace the mandible towards the contralateral side without fracturing it. If there is a subcondylar fracture, it most likely occurred after superolateral dislocation; if fracture had occurred prior to dislocation the condylar fragment would have remained medial to the ramus of the mandible [21]. Taking this into account it is possible that the first impact our patient in case one sustained may have been while his mouth was open. This impact fractured his right angle which possibly facilitated the rotation and movement of his left ramus which contributed to the superolateral dislocation of his left condyle together with subsequent impacts. The same is possible for the patient in case two.

Worthington [19] proposed diagnostic features that should arouse a clinician's suspicion of a superolaterally displaced condyle [1–4,14–16,18–20,24,28]. These include a malocclusion that persists after other jaw fractures have been reduced, persistence of an open bite, persistence of a restriction of mandibular movement, an appearance of apparent loss of ramus height with elevation of the ramus fragment and facial asymmetry [19]. In addition to these diagnostic features patients may also present with a bony hard preauricular prominence (as was the case in our first patient) causing facial asymmetry [4,8,12], mandibular deviation towards the ipsilateral side [8], painful mandibular movements caused by stretching of the ligaments around the temporomandibular joint and intraarticular effusion [4], speech and masticatory difficulties due to muscle spasms and joint pain [4], a crossbite [4,12] and in some situations other mandibular fractures [4,8,12]. As illustrated in our second case, an intact occlusion does not necessarily exclude superolateral dislocation.

The clinical signs of patients with superolateral dislocations of the mandibular condyle should be assessed with caution as patients with intracranial dislocations may have similar signs. Patients with intracranial dislocation of the mandibular condyle may also present with signs such as inability to open the mouth or move the mandible [32,33], ipsilateral open bite, contralateral cross bite and premature contact [32,33], deviation of the mandibular midline towards the affected side [32,33], lack of mandibular excursions [32], facial asymmetry [32], ipsilateral facial height loss [33], chin lacerations [33], preauricular pain [33] and possible neurological signs and symptoms [32]. Overlap of the clinical signs between the two dislocations necessitates a detailed radiological assessment in order to differentiate them. In the case of intracranial dislocation conventional radiography may be insufficient for diagnosis although it could reveal the dislocation initially, however, computed tomography (especially coronal CTs) scans are mandatory to locate the fracture fragments, identify possible intracranial pathology and to confirm the clinical suspicion [34,35].

The diagnosis of a superolateral dislocation can be confirmed by radiographs [19,20] and more accurately by computed tomography (CT) scans [4,19,20,23,24]. The dislocated condyle, type of dislocation, associated fractures as well as whether there is a fracture of the condyle or not are clearly demonstrated by CT scans [24].

The delay in treatment reported in the literature has varied with some reductions being performed on the day of injury to a delay of up to 45 days before reduction is performed. The delay in some instances is owed to late presentation of patients. The average delay in treatment is approximately 8 days. Our patients presented to us 56 and 73 days after injury and were taken to theatre on day 57 and 74 respectively. Despite the fact that the fractures were very old, a decision was taken to osteotomize the fractured segments and to attempt to relocate the left condyle in order to prevent TMJ ankylosis. To our knowledge this is the longest delay in treatment reported for superolateral dislocation of an intact mandibular condyle. Intra-operatively a bony fusion was starting to develop between the dislocated condyle and the zygomatic arch.

Returning the dislocated condyle to its physiological position is the goal of treatment for any condylar dislocation [5,6,10,17,18]. Relocation can be achieved by manual (closed) reduction or open reduction. Manual reduction is the preferred method of reduction for acutely dislocated condyles as it is the simplest, safest and least traumatic [4,18,22,26]. This is best achieved under general anaesthesia

Table 1
Reported cases of superolateral dislocation of intact mandibular condyles from 1969 to 2018.

Authors	Year	Age (Years)	Gender	Mechanism	Unilateral or Bilateral	Side and Type	Associated fractures	Delay in treatment (Days)	Method of reduction	Period of post-operative IMF (Weeks)	Result
Allen et al. [12]	1969	16	Male	RTA	Unilateral	Right I	Symphyseal and zygomaticomaxillary complex fracture	8	Closed		Fibro – osseous ankylosis and mouth opening 20mm at 5 years and slight malocclusion
		50	Male	RTA	Unilateral	Left II		15	Closed		
		36	Male	RTA	Bilateral	Right I &	Parasymphyseal fracture	1	Closed		
		22	Male	RTA	Unilateral	Left I	Parasymphyseal fracture	1	Closed		
		30	Male	RTA	Unilateral	Left I Right II	Symphyseal fracture Parasymphyseal fracture	1	Closed		Mouth opening 15mm at 4 years and malocclusion 25% reduction in range of movement at 1 year Full range of jaw movements at 1 year Not available
Brusati et al. [30]	1978	19	Male	RTA	Unilateral	Left IIB	Symphyseal and left coronoid process fracture	2	Closed		With facial palsy, not described
		13	Female	RTA	Unilateral	Right IIB	Fracture of right mandibular body and left condyle	12	Open		With facial palsy, full jaw motion
Worthington [19]	1982	11	Female	RTA	Unilateral	Unusual	Parasymphyseal fracture	14	Open	2	Fibro – osseous ankylosis
Devita et al. [31]	1988	28	Female	RTA	Bilateral	Left II & Right II	None		Open	2	Not available
Ferguson et al. [29]	1989	31	Male	Fall	Unilateral	Right IIB	Symphyseal fracture	1	Closed		With facial palsy, not described
Satoh et al. [23]	1994	48	Male	RTA	Bilateral	Left IIA & Right IIA	Symphyseal (Bilateral) and coronoid fracture	13	Closed	3	Condylectomy, 30mm mouth opening
Kapila et al. [11]	1996	42	Male	RTA	Unilateral	Left IIB	None	7	Closed	3	Mouth opening 30mm at 6 months
Hoard et al. [1,2,5,6,13,18,24,25]	1998	36	Male	RTA	Bilateral	Left II & Right II	None		Closed		Not available
Yoshii et al. [20]	2000	1	Female	RTA	Unilateral	Left II	Left zygomatic arch and right parasymphyseal fracture	16	Closed		Mouth opening 20mm
Hsieh [2,4–6,13,25]	2007	23	Male	RTA	Bilateral	Left II & Right II	Symphyseal fracture	1	Closed		Mouth opening 41mm
Bu et al. [1]	2007	42	Male	RTA	Unilateral	Left IIC	None	5	Closed	2	Mouth opening 37mm
Lloyd et al. [8]	2009	20	Male	RTA	Unilateral	Left II	None		Open	1	Mouth opening of 30mm at one year with slight deviation of mandible
Hedge et al. [3]	2010	32	Male	RTA	Unilateral	Left IIB	None	14	Open	2	
Papadopolous et al. [22]	2010	16	Male	RTA	Unilateral	Right IIC	None	1	Open	2	Mouth opening of 32mm after 6 weeks
Tauro et al. [18]	2010	25	Male	RTA	Unilateral	Left IIA	Symphyseal fracture	3	Closed		Mouth opening 32mm at 8 months and deviation to right
Prabhakar et al. [13]	2011	47	Female	Fall	Bilateral	Left II & Right II	None	45	Open	3	Mouth opening 33mm
Amaral et al. [24]	2011	15	Female	RTA	Unilateral	Left IIB	Symphyseal, right condyle, right zygomaticomaxillary complex, naso-orbital ethmoid complex and frontal sinus fracture	1	Closed	2	Mouth opening 30mm

(*continued on next page*)

Table 1 (*continued*)

Authors	Year	Age (Years)	Gender	Mechanism	Unilateral or Bilateral	Side and Type	Associated fractures	Delay in treatment (Days)	Method of reduction	Period of post-operative IMF (Weeks)	Result
Radhakrishna et al. [26]	2013	50	Male	RTA	Unilateral	Left IIC	Right mandibular body fracture and dentoalveolar fracture from 33 to 44	5	Closed	2	Mouth opening 30mm after 1 month
Shen et al. [25]	2013	40	Male	RTA	Unilateral	Left IIB	Symphyseal fracture	4	Closed		Mouth opening 34mm at 2 years
		20	Male	RTA	Bilateral	Left IIB & Right IIB	Symphyseal fracture	12	Open		Mouth opening 33mm at 18 months
		32	Male	RTA	Unilateral	Right IIB	Symphyseal fracture	17	Open		Mouth opening 37mm at 13 months
		20	Male	RTA	Unilateral	Right IIA	Right mandibular angle fracture	5	Closed		Mouth opening 41mm at 17 months
		58	Male	Fall	Unilateral	Right IIA	Symphyseal fracture	6	Closed		Mouth opening 34mm at 25 months
		27	Male	RTA	Unilateral	Right IIB	Symphyseal fracture	27	Open		Mouth opening 36mm at 17 months
		39	Male	RTA	Bilateral	Left IIA Left IIB & Right IIB	Symphyseal fracture	35	Open		Mouth opening 27mm at 6 months
Kim et al. [5,7]	2013	54	Male	RTA	Bilateral	Left I & Right IIB	Symphyseal fracture	4	Closed	1	
Singh et al. [2]	2013	22	Male	RTA	Bilateral	Left IIA & Right IIB	Left parasymphyseal and maxillary dentoalveolar fracture	2	Closed	None	Mouth opening 34 m at 6 months with satisfactory occlusion
Saraswathi [5]	2013	8	Female	Fall	Unilateral	Left IIB	None		Closed		Mouth opening 35mm
Chaitanya [5]	2013	4	Female	Fall	Unilateral	IIC	None	6	Open		Mouth opening 30mm
Gupta [7]	2014	35	Male	RTA	Bilateral	Left IIB & Right IIB	Symphyseal fracture	1	Closed		
Mishra et al. [28]	2015	33	Male	Fall	Unilateral	Left IIB	Right parasymphyseal fracture	7	Closed	4	
		25	Male	RTA	Bilateral	Left I &	Left parasymphyseal fracture	7	Closed	4	
		28	Female	RTA	Unilateral	Right I	None	7	Open	4	
		25	Male	RTA	Unilateral	Right IIB	Left parasymphyseal, left	7	Closed	4	
		30	Male	RTA	Bilateral	Right IIA Left IIB & Right IIB	zygomaticomaxillary complex, nasal bone fractures Symphyseal and left Le Fort I fracture	7	Closed	4	
Rajkumar et al. [27]	2015	42	Male	Fall	Bilateral	Left IIB & Right IIB	Right incomplete parasymphyseal fracture	4	Open (Left) Closed (Right)	3	Not available
Saikrishna et al. [6]	2016	41	Male	RTA	Unilateral	Left IIB	Symphyseal, Le Fort II, palatal split and naso-orbital ethmoid complex fracture	7	Open	1	Mouth opening 33mm and full range of movement
Patil et al. [14]	2016	25	Male	Fall	Bilateral	Left IIB & Right IIB Left IIB & Right IIB	Symphyseal fracture	2	Closed	2	
		14	Female	RTA	Bilateral		Symphyseal fracture	4	Closed	2	
		32	Male	RTA	Bilateral		Symphyseal fracture	3	Closed	2	
Sharma et al. [4]	2016	30	Male	RTA	Unilateral	Left IIB	Left parasymphyseal fracture	20	Open	2	Good range of mandibular movement and satisfactory mouth opening at 6 months
Srinath et al. [7]	2017	48	Female	Fall	Unilateral	Right IIA	None	4	Closed	2	

(*continued on next page*)

Table 1 (*continued*)

Authors	Year	Age (Years)	Gender	Mechanism	Unilateral or Bilateral	Side and Type	Associated fractures	Delay in treatment (Days)	Method of reduction	Period of post-operative IMF (Weeks)	Result
											At 4 weeks 35mm mouth opening with deviation to right
Bhutia et al. [5]	2017	40	Male	RTA	Unilateral	Left IIA	Right angle fracture	3	Closed	2	Mouth opening 35mm at 13
		32	Male	RTA	Bilateral	Left I &	Left parasymphyseal fracture	5	Closed	2	months, full range of
		11	Female	RTA	Bilateral	Right IIB	Left body fracture	5	Closed	2	movement
		35	Male	RTA	Unilateral	Left I &	Left body fracture	9	Closed	2	Mouth opening 35mm at 24
		30	Male	RTA	Unilateral	Right IIA	Left parasymphyseal fracture	4	Closed	2	months, full range of
		32	Male	RTA	Bilateral	Right IIA	Right parasymphyseal fracture	9	Closed	2	movement
		60	Male	RTA	Bilateral	Left IIC	Right parasymphyseal fracture	9	Closed	2	Mouth opening 30mm at 7
		28	Male	RTA	Bilateral	Left I & Right IIA Left I & Right I Left I & Right I	Left parasymphyseal fracture	7	Closed	2	months, full range of movement Mouth opening 42mm at 3 months, full range of movement Mouth opening 40mm at 5 months, full range of movement Mouth opening 36mm at 3 months, 75% range of movement Mouth opening 30mm at 5 months, 75% range of movement Mouth opening 32mm at 6 months, full range of movement
Hira et al. (Current cases)	2018	24	Male	RTA	Unilateral	Left IIB	Le Fort III right angle, right hemimaxillary fracture Left subcondylar fracture	57	Open	2	Mouth opening 20mm at 12
		27	Male	RTA	Unilateral	Left IIA		74	Open	2	months, full range of movement. Mouth opening 30mm at 7 months, full range of movement

due to the difficulty and patient comfort. General anaesthesia allows the surgeon the opportunity to reduce and fixate other fractures at the same time and also the option to perform an open reduction on the dislocated condyle should manual reduction fail.

Different methods of manual reduction have been described in the literature. Dislocations have been reduced with a mouth gag placed in between the occlusal surfaces of the molars which is then opened wide such that the patient's mouth is opened widely following which the mouth gag is rotated to pull the dislocated condyle [4]. A method using heavy manual traction together with downward traction by a wire twister attached to a wire loop on the molars using an arch bar is also reported [4]. A bone hook placed in the sigmoid notch can also be used to provide traction [4,5,14]. Kapila et al. [11] and Ferguson et al. [29] described a technique where wires placed in holes drilled in the exposed angle of the mandible were used to provide traction (Finck's technique) [5,6,14,18]. The Muselet technique has also been described where a 0.8mm thick wire is placed intraorally through a hole drilled in the rami which is then twisted on itself while pulling inferiorly thereby pulling both rami inferiorly and medially reducing the joint [5,14].

Open reduction has been used by authors to reduced dislocations that presented both early as well as delayed. This is usually performed via a preauricular approach [6,15,18]. For those superolateral dislocations that presented early and were treated by open reduction reasons included cases not responding to manual reduction [4,7,18], the type of dislocation (i.e. the condyle being lodged within or hooked above the zygomatic arch) [4,7,18], the age of the patient [7] and difficult cases [4,6,18] while reasons for open reduction for those cases with delayed presentation included the fibrous adhesions [4,6,8,18,20–22], haematoma formation [8], myospasm [4], bone union [4] or a combination of these [4] that occurs in long standing dislocations, the type of dislocation as was the case for open reduction of those presenting early [4,7,18] and difficult cases [4,6,18].

Sharma et al. [4] supported the finding that closed reduction techniques can be used for Type I, Type II A, Type III A and possibly Type II C and Type III C dislocations [4,7]. However, Sharma et al. [4] suggest that Type II B and Type III B dislocations may require open reduction to enable the condyle to be "unhooked" from the zygomatic arch [4,7]. Long standing dislocations may also require open reduction [15] as did our patient.

The period of immobilisation post-operatively has varied in the literature with an average of 2 weeks from the cases in which post-operative intermaxillary fixation is reported. In the cases where it is specified, the duration varied from no immobilisation to 4 weeks. Despite post-operative intermaxillary fixation being required to facilitate healing of the presumably damaged temporomandibular joint capsule [5] and ligaments [14,24] irrespective of the method of reduction used, the controversy surrounding the period of immobilisation centres on a short period posing the risk of redislocation [8,20,24] and a prolonged period posing the risk of ankylosis [8]. All patients in our series were placed in intermaxillary fixation for 2 weeks followed by rigorous jaw physiotherapy. Mouth opening exercises and jaw physiotherapy are indicated to minimise the risk of ankylosis [8,24] and to encourage return to normal jaw function [8].

Brusati et al. [30] first reported facial nerve palsy in patients with superolateral displacement of the condyle. They proposed this neuropraxia to be due to the extrapetrosal peripheral segment of the facial nerve being in close proximity to the ramus of the mandible and stated that the nerve may be affected by injuries involving fractures of the ramus (especially the condylar process) or by injuries causing significant dislocation without actual fracture of the ramus [4,6,9,14,17,30] resulting in traction in the nerve that is more than its anatomical limit [5,18]. This nerve injury should resolve in 6–9 months [14,18]. Our patient in case one had weakness of the frontal branch of the facial nerve post-operatively. The facial nerve was not assessed prior to surgery and we would therefore recommend that the condition of the facial nerve be evaluated and documented before treatment.

Unsuccessful reduction results in facial asymmetry, limited mouth opening due to fibro-osseous ankylosis and a malocclusion [5,6,14,17,18,21]. A maximal mouth opening over 30mm and a good occlusal relationship 5 months after reduction is considered a successful reduction of a superolateral dislocation of the mandibular condyle [5,24,25].

5. Conclusion

Despite the rarity of superolateral dislocations of the mandibular condyles they can be easily diagnosed based on thorough clinical findings and computer tomography scans. Reduction (as soon as it is diagnosed) of the dislocated condyle into its original physiologic position in the glenoid fossa should be the goal. Reduction should be followed by immobilisation and physiotherapy to reduce the risk of temporomandibular ankylosis and to improve the mouth opening to as close to normal jaw function as possible. Limited mouth opening due to poor patient compliance in our first case underscores the value of post-operative physiotherapy in these patients.

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Conflicts of interest

None.

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