

Controversies in the Management of Mandibular Condylar Fractures: A Narrative Review of Anatomy, Diagnosis, Classification, Treatment Modalities, and Complications

Pragya Sharma¹, D. S. Gupta¹

¹Department of Oral and Maxillofacial Surgery, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, Uttar Pradesh, India.

Abstract

Background: Fractures of the mandibular condyle account for approximately 25–40% of all mandibular fractures and remain one of the most debated entities in maxillofacial traumatology. Despite more than nine decades of accumulated clinical experience, no universally accepted protocol exists for choosing between closed (conservative) reduction and open reduction with internal fixation (ORIF). The objective is to synthesize and critically appraise the anatomical, diagnostic, classificatory, therapeutic, and complication-related evidence on mandibular condylar fractures, and to clarify the principal areas of ongoing controversy in their management. **Subjects and Methods:** A structured narrative review was undertaken of 45 primary and secondary sources published between 1927 and 2025, spanning foundational classification studies, comparative clinical trials, systematic reviews and meta-analyses, and contemporary innovations in fixation technology. Data were extracted on diagnostic accuracy, classification frameworks, treatment indications, surgical approaches, and quantitative complication rates, and evidence was graded using a standard three-tier level-of-evidence framework. **Results:** Nine major classification systems have been proposed since 1927, of which the Spiessl and Schroll and Lindahl systems remain the most clinically applied. Computed tomography demonstrated higher sensitivity than orthopantomography for fracture detection (100% vs 87.5% overall; 92% vs 70% in children). Pooled complication rates after ORIF were led by transient facial nerve weakness (8.3%, with 0.3% permanent), followed by hardware-related complications (1.79%), salivary leakage (1.62%) and salivary fistula (1.11%); closed reduction was associated with inadequate condylar remodeling in 3.05% of cases. Of the key comparative studies reviewed, findings were evenly split between those favouring ORIF and those favouring conservative management, reflecting genuine equipoise in the literature rather than a clear consensus. **Conclusion:** No single management strategy is universally superior. Treatment selection should be individualized according to patient age, fracture level and displacement, occlusal status, and surgeon expertise, with ORIF increasingly favoured for displaced or dislocated fractures in adults and conservative management remaining the standard for minimally displaced and pediatric fractures. Further multicentric randomized trials with standardized outcome measures are required to resolve the long-standing debate.

Keywords: Mandibular condylar fracture, open reduction internal fixation, closed reduction, facial nerve injury, temporomandibular joint, maxillofacial trauma.

Corresponding Author: Dr. Pragya Sharma, Department of Oral and Maxillofacial Surgery, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, Uttar Pradesh, India.

Email: pragyapandit2@gmail.com

Received: 10-04-2026

Revised: 23-04-2026

Accepted: 02-05-2026

Published: 30-06-2026

Introduction

Mandibular fractures are among the most frequently encountered injuries in maxillofacial trauma practice, and within this group, fractures of the condylar process represent a disproportionately large and clinically significant subset, accounting for approximately 25–40% of all mandibular fractures.^[1,2] The condyle is the sole articulating component of the mandible and forms, together with the glenoid fossa and articular disc, the temporomandibular joint (TMJ) — a structure central to mastication, speech, deglutition, and, in the growing patient, to normal mandibular development. Injury to this region therefore carries implications that extend well beyond the fracture line itself, and the management of condylar fractures continues to generate more debate than

perhaps any other injury in the maxillofacial skeleton.

The mandibular condyle — comprising the condylar head, neck, and subcondylar region — is structurally slender and biomechanically vulnerable relative to the rest of the mandible. When force is transmitted through the mandibular arch, most commonly from a direct blow to the chin or parasymphysis, the condylar region is frequently the point of structural failure because of its relative anatomical weakness.^[3] This behaviour has classically been likened to a hunting bow: the mandible is weak at its extremities and strong at the midline, so that a symphyseal impact is transmitted around the arch to fracture one or both condyles, while a parasymphyseal blow more typically produces a contralateral (contrecoup) condylar fracture. The direction and magnitude of the traumatic force, together with the

unopposed pull of the lateral pterygoid muscle on the proximal fragment, jointly determine the fracture pattern and the degree of displacement, so that condylar injuries range from undisplaced intracapsular cracks to grossly displaced or dislocated extracapsular fractures with complete loss of condyle–fossa relationship.^[4]

Epidemiologically, condylar fractures occur predominantly in young adult males, reflecting their disproportionate exposure to road traffic collisions, interpersonal violence, falls, and sporting injury.^[5] Road traffic accidents remain the leading global cause, although the relative contribution of assault and domestic falls varies considerably by region and by the socio-economic profile of the population studied.^[6] The paediatric condyle merits distinct consideration: because it functions as a secondary growth centre for the mandible, injury in childhood carries a specific risk of ankylosis, growth arrest, and facial asymmetry if managed inappropriately, even though the immature skeleton also possesses a markedly superior capacity for post-traumatic remodelling.^[7]

Clinically, patients with condylar fractures typically present with preauricular pain and swelling, restricted or deviated mandibular opening, malocclusion, and — in fractures with intracapsular extension or associated temporal bone involvement — bleeding from the external auditory canal or hemotympanum.^[8] Bilateral condylar fractures produce a characteristic anterior open bite with posterior mandibular rotation and severe functional compromise. Left inadequately diagnosed or treated, condylar fractures may progress to persistent malocclusion, temporomandibular dysfunction, ankylosis, loss of posterior facial height, and, in children, disturbance of mandibular growth.^[9]

A substantial body of classification literature has accumulated since Wassmund's earliest descriptive system of 1927, with subsequent frameworks organizing fractures by anatomical location (intracapsular, condylar neck, or subcondylar), by displacement and dislocation, and by laterality (unilateral or bilateral).^[10] These classifications are not merely descriptive: fracture level and displacement are the principal determinants guiding the choice between conservative and surgical management, and much of the controversy surrounding condylar fractures stems directly from disagreement over how these radiological criteria should translate into treatment thresholds.

The management of condylar fractures has oscillated for decades between closed and open treatment philosophies. Closed treatment — historically the default approach — relies on intermaxillary fixation and functional therapy, and avoids surgical morbidity, but carries a recognized risk of malocclusion, restricted mandibular excursion, and imperfect anatomical reduction.^[11] Advances in imaging, plating systems, and surgical technique have progressively shifted practice toward open reduction and internal fixation (ORIF) in selected cases, particularly displaced fractures or those with demonstrable functional impairment.^[12] ORIF permits direct visualization, anatomical reduction, and rigid stabilization, and is generally associated with more predictable restoration of occlusion and ramal height, but this benefit must be weighed against the risk of facial nerve

injury, visible scarring, and the morbidity of a surgical procedure and general anaesthesia.^[13]

Given this complexity, treatment planning for condylar fractures cannot follow a single algorithm; it must be individualized according to patient age, fracture level, degree of displacement, dentition and occlusal status, and the presence of associated injuries. Contemporary practice increasingly favours a balanced, criteria-based approach — non-surgical management for minimally displaced fractures and for children, and ORIF for displaced, dislocated, or functionally significant fractures in adults.^[14] Innovations such as endoscope-assisted ORIF, resorbable fixation systems, three-dimensional virtual surgical planning, and intraoperative navigation are progressively expanding the surgical envelope while aiming to minimize morbidity.

Because the evidence base on condylar fractures is large, heterogeneous, and drawn from nearly a century of publication, a consolidated synthesis is of practical value to the clinician confronted with a management decision at the bedside. The present review therefore had three specific aims: first, to summarize the anatomical, diagnostic, and classificatory foundations relevant to condylar fracture management; second, to extract and quantify the comparative and complication data reported across the classic and contemporary literature on conservative versus surgical treatment; and third, to identify and characterize the principal points of ongoing controversy, in order to inform a more structured, evidence-based approach to this common but complex injury.

Subjects and Methods

This article is a structured narrative review compiled from a dedicated postgraduate dissertation on the management of mandibular condylar fractures, undertaken in the Department of Oral and Maxillofacial Surgery. The evidence base comprised 45 primary and secondary sources published between 1927 and 2025, encompassing foundational classification papers, comparative and prospective clinical studies, systematic reviews and meta-analyses, biomechanical and cadaveric studies, and contemporary reports on fixation technology and minimally invasive technique.

Sources were organized thematically to address six domains relevant to clinical decision-making: (i) surgical anatomy and injury biomechanics; (ii) diagnostic imaging; (iii) classification systems; (iv) conservative and surgical treatment modalities, stratified by age group (paediatric, adult, and geriatric); (v) surgical approaches to the condyle; and (vi) complications following closed and open management. For each domain, quantitative findings — diagnostic sensitivity and specificity, reported complication frequencies, and comparative functional outcomes — were extracted and tabulated to allow direct comparison across studies. Where multiple studies reported overlapping outcome data (for example, transient facial nerve weakness by surgical approach), the reported ranges are presented rather than a single pooled estimate, since the source studies

were not homogeneous enough to justify formal meta-analytic pooling.

Methodological quality and applicability of the underlying evidence were graded using the three-tier level-of-evidence framework adapted from the U.S. Preventive Services Task Force,^[37] summarized in [Table 1]. This framework was applied throughout the parent dissertation to qualify statements of fact drawn from the literature and is retained here for the same purpose.

Table 1: Level-of-evidence framework applied to the reviewed literature (adapted from Harris et al., 2001).^[37]

Level	Study design
I	Evidence obtained from at least one properly designed randomized controlled trial.
II-1	Evidence obtained from well-designed controlled trials without randomization.
II-2	Evidence obtained from well-designed cohort or case-control analytical studies, preferably from more than one centre or research group.
II-3	Evidence from multiple time-series studies, with or without intervention; dramatic results in uncontrolled experiments may also be regarded as this type of evidence.
III	Opinions of respected authorities based on clinical experience; descriptive studies and case reports; or reports of expert committees.

This review is narrative rather than systematic in design: no formal database search protocol, dual-reviewer screening, or PRISMA-based selection process was applied, and the source material reflects the reference list compiled by the original authors rather than an exhaustive, reproducible

search. This is an acknowledged limitation and is discussed further in Section 5.4.

Results

Applied Surgical Anatomy and Biomechanics

The mandibular condyle is an oval, knuckle-like projection arising from the posterior-superior ramus, angulated 15–33° to the frontal plane, with a medio-lateral width of 15–20 mm and an antero-posterior width of 8–10 mm⁴. It develops by intramembranous ossification from mesenchymal condensation lateral to Meckel's cartilage, and articulates with the glenoid fossa of the temporal bone through a fibrocartilaginous disc. The joint capsule, sphenomandibular and stylomandibular ligaments provide passive support, while the inferior head of lateral pterygoid inserts on the pterygoid fovea of the condylar neck and is the principal muscle responsible for anteromedial displacement of the proximal fragment after fracture.

Surgical anatomy of the region is dominated by the proximity of the facial nerve: its bifurcation lies 1.5–2 cm from the bony external auditory canal, the temporal branch runs 8–35 mm from the canal, and the marginal mandibular branch lies approximately 1.2 cm from the inferior mandibular border⁴. These measurements underpin the risk of iatrogenic nerve injury common to every extraoral surgical approach described in Section 3.5. The paediatric condyle differs substantially from the adult condyle in structural terms, a distinction with direct treatment implications. [Table 2]

Table 2: Anatomical differences between the paediatric and adult mandibular condyle⁴

Feature	Paediatric	Adult
Cortical bone	Thin	Thick
Condylar neck	Broad	Thin
Articular surface	Thin	Thick
Capsule	Highly vascular	Less vascular

Biomechanically, the mandible behaves as a “hunting bow” — weak at its extremities and strong at the midline symphysis — such that a midline impact is transmitted around the arch to produce bilateral condylar fractures, while a parasymphyseal blow classically produces a contralateral (contrecoup) condylar fracture; this pattern, historically termed the “parade-ground” or “guardsman” fracture, was first described in soldiers who fainted while standing at attention⁴. Fracture-specific anatomical distortion varies by level: intracapsular (condylar head) fractures carry the highest risk of TMJ ankylosis and arthritic change owing to direct articular disruption; condylar neck fractures are the

most common site overall due to the anatomical narrowing at this level and typically displace medially and anteriorly under lateral pterygoid traction; and subcondylar fractures, while more surgically accessible, may still produce ramal shortening and malocclusion.

Diagnostic Imaging

Plain orthopantomography (OPG), postero-anterior/reverse Towne's views, computed tomography (CT), cone-beam CT (CBCT), and magnetic resonance imaging (MRI) each contribute complementary information to the diagnostic work-up of condylar fractures. [Table 3]

Table 3: Comparative overview of imaging modalities in condylar fracture diagnosis^{15–25}

Modality	Advantages	Limitations	Primary indication
OPG	Widely available, economical	Superimposition of structures, lower accuracy	Initial screening
Reverse Towne's / PA skull	Assesses medial-lateral displacement	Poor overall accuracy	Largely historic use
CT	3-D visualization; gold standard	Higher radiation dose and cost	Surgical planning; polytrauma
CBCT	Lower radiation dose; accurate for bone	Limited soft-tissue detail	Ambulatory diagnosis
MRI	Superior disc and soft-tissue evaluation	Expensive; limited bony detail	Suspected TMJ disc injury

Quantitatively, CT was more sensitive than OPG for

detecting condylar fractures overall (100% vs 87.5%)¹⁵, and

this advantage was more pronounced in children, where CT achieved 92% sensitivity and 87% specificity compared with 70% sensitivity and 77% specificity for OPG21 [Figure 2] Coronal CT was also more accurate than conventional radiographs for high-neck condylar fractures (Spiessl types III and V)16, and although two-dimensional and three-dimensional CT reconstructions showed comparable diagnostic accuracy, three-dimensional CT provided superior visualization of fragment position, displacement, and comminution when checked against intraoperative findings, making it particularly useful for surgical planning.^[22] CBCT confirmed clinically or radiographically suspected fractures in 63.2% of sites ($p < 0.0001$), supporting its role as an ambulatory alternative to CT in patients without loss of consciousness.^[25]

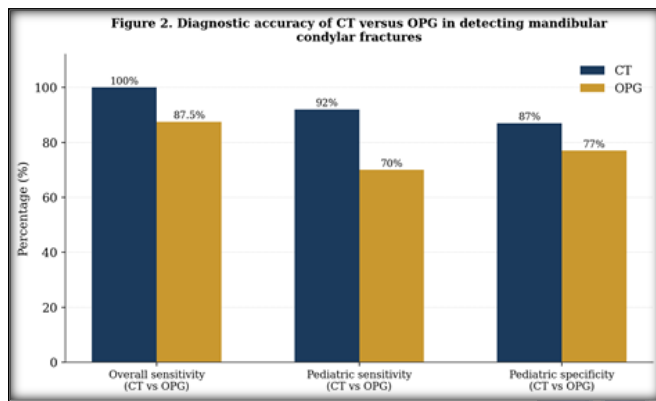


Figure 2: Diagnostic accuracy (sensitivity/specificity) of CT versus OPG in detecting mandibular condylar fractures, overall and in the paediatric subgroup.

Classification Systems

Nine major classification systems for condylar fractures have been proposed over the past century, reflecting a progressive shift from purely descriptive, displacement-based schemes toward radiographically and surgically oriented frameworks [Figure 1, Table 4]. Wassmund's early system (1927/1934) categorized fractures by bony contact and angulation of the condylar head; Spiessl and Schroll's surgically oriented six-type classification (1972) remains widely used to guide the decision for ORIF; Lindahl's system (1977) added prognostic value by correlating fracture level, deviation, and condyle–fossa relationship with functional outcome; and more recent systems — Loukota's "Line A" reference (2005), the AO/CMF trauma classification (2006), the International Consensus on Condylar Fractures (ICMF, 2012), Neff's disc-based system (2014), and Ying's pediatric-focused classification (2017) — have progressively incorporated three-dimensional imaging and disc position into fracture description.

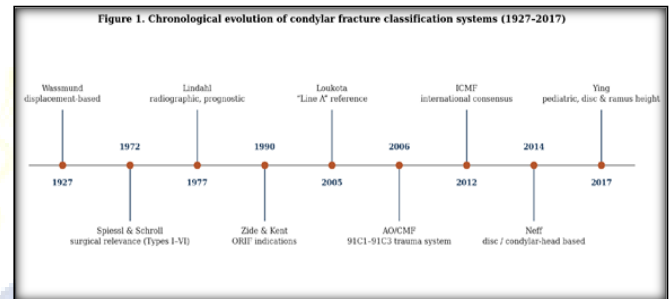


Figure 1: Chronological evolution of the major condylar fracture classification systems, 1927–2017

Table 4: Summary of classification systems for condylar fractures

Author / Year	Basis / key feature	Clinical use
Wassmund (1927, 1934)	Displacement and angulation; Types I–III	Historical reference
Spiessl & Schroll (1972)	Surgical relevance; Types I–VI	Guides ORIF decision-making
Lindahl (1977)	Radiographic relation to fossa; head/neck/base	Prognostic relevance
Loukota (2005)	"Line A" anatomical reference	Clinical and research use
AO/CMF (2006)	Comprehensive trauma system, 91C1–91C3	Research standardization
ICMF (2012)	International consensus on location and displacement	Standard terminology
Neff (2014)	Disc position and condylar-head reference lines	Surgical planning
Ying (2017)	Disc displacement and ramus height; Types A–C	Paediatric focus

Beyond formal classification, condylar fractures are also described clinically by anatomical location (intracapsular, neck, or subcondylar), by displacement/dislocation status (non-displaced, deviated, displaced, or dislocated), and by laterality, all of which carry direct therapeutic implications discussed in Section 3.4.

Treatment Modalities: Conservative versus Surgical Management

Conservative (closed) management

Closed treatment relies on maxillomandibular fixation (MMF) — achieved with arch bars, IMF screws, or splints — combined with guiding elastics and, critically, early functional physiotherapy. Immobilization is conventionally maintained for 4–6 weeks in adults but only 7–10 days in children, reflecting the paediatric skeleton's susceptibility to ankylosis with prolonged fixation9. Its principal advantages

are simplicity, avoidance of general anaesthesia and facial nerve risk, low cost, and a lower infection rate; its principal disadvantages are the potential for inadequate reduction with unfavourable muscle pull on the proximal fragment, prolonged patient morbidity, and unsuitability in patients at risk of aspiration or with poor compliance.^[13]

Age-specific protocols differ substantially. In children, the rationale for non-surgical management rests on high remodeling potential and the risk of growth-centre injury with surgical trauma; the widely cited Kaban protocol. [Table 5] stratifies management by displacement and occlusal status, reserving open reduction for rare cases of dislocation or bilateral displacement.^[9] In geriatric patients, osteoporotic bone, reduced vascularity, and comorbidities generally favour conservative management with a Gunning splint in edentulous patients, prioritizing avoidance of surgical and

anaesthetic risk over anatomical perfection. [Table 6]

Table 5: Kaban's protocol for paediatric condylar fractures (Kaban, 1993 – Harvard School of Dental Medicine)

Fracture type	Management
Undisplaced	Observation and soft diet
Displaced, normal occlusion	Functional therapy
Displaced, with malocclusion	Short-term IMF (≤ 10 days) with physiotherapy
Dislocation / bilateral displacement	Open reduction considered only in select, rare cases

Table 6: Management approach in geriatric patients

Management	Treatment plan
Conservative preferred unless severely displaced with occlusal derangement	Soft diet, analgesics, physiotherapy
Very short-term IMF or guiding elastics, if required at all	Supportive occlusal splints

Surgical management (ORIF)

The Zide and Kent criteria remain the most widely cited indications for ORIF and distinguish absolute from relative indications.^[5,14] Absolute indications include displacement of the condyle into the middle cranial fossa, impossibility of achieving occlusion by closed means, dislocation from the glenoid fossa, and lateral extracapsular displacement. Relative indications include contraindication to intermaxillary fixation, bilateral fracture with open bite, bilateral fracture with comminuted midface injury, periodontal compromise with tooth loss, and unilateral fracture with an unstable base.

Fixation options include a single miniplate (adequate for many neck fractures but showing the greatest peak fragment displacement biomechanically), two miniplates placed to resist torsional forces, geometric (L-, Y-, trapezoidal, or delta-shaped) plates offering the most functionally stable osteosynthesis, resorbable plates (avoiding revision surgery but biomechanically less stable than titanium), and lag screws, which perform particularly well in diacapitular/sagittal head fractures.^[18,19,20,21] Meyer's ideal

lines of osteosynthesis — a zone of tension along the anterior condylar border and sigmoid notch, and a zone of compression along the posterior ramal border — continue to inform plate positioning.^[18]

Recovery benchmarks used to define successful treatment, irrespective of modality, include mouth opening exceeding 40 mm in adults (35 mm in children), absence of pain at the fracture site, full-range mandibular movement, recovery of pre-injury occlusion, TMJ stability, minimal chin deviation on opening, and absence of visible facial asymmetry.

Surgical Approaches to the Condyle

Seven surgical approaches to the condylar region have been described, each with a distinct exposure-versus-morbidity trade-off. [Table 7] Approach selection is principally governed by fracture level: condylar head fractures are best accessed via the preauricular or endaural routes; condylar neck fractures via the retromandibular approach, often with preauricular extension; and condylar base/subcondylar fractures via the submandibular, retromandibular, or intraoral routes.^[17]

Table 7: Comparison of surgical approaches for condylar fracture exposure

Approach	Typical indication	Advantages	Principal risk
Preauricular	High condylar head fracture	Direct TMJ access; scar hidden in skin crease	Temporal branch of facial nerve
Retromandibular	Neck and subcondylar fractures	Good access; relatively inconspicuous scar	Marginal mandibular branch; salivary fistula
Submandibular (Risdon)	Low condylar/subcondylar fractures	Straightforward access	Marginal mandibular branch; visible scar
Intraoral	Selected subcondylar fractures	No external scar; no facial nerve exposure	Limited visualization
Endoscopic-assisted	Minimally invasive ORIF	Reduced scarring; nerve-safe	Steep learning curve; equipment cost
Postauricular	Neck/subcondylar, esthetic priority	Scar concealed in postauricular sulcus	Facial nerve weakness 0–5%
Endaural	Condylar head and neck	Scar camouflaged in ear folds	Facial nerve weakness 2–7%; canal injury

Reported rates of transient facial nerve weakness varied meaningfully by approach and were lowest for the postauricular route (0–5%) and endaural route (2–7%), intermediate for the retromandibular transparotid approach (8–10%),^[28] and highest when pooled across the conventional preauricular, retromandibular, and submandibular approaches generally (8–14%),^[23] [Figure 4] Across all approaches, the great majority of facial weakness is neuropraxic and resolves within weeks to months; permanent paralysis is rare (well under 2%) with contemporary technique.^[14] Comparative work specifically contrasting the preauricular and retromandibular approaches

found superior visualization of the condylar head with the preauricular route, against slightly less visible scarring but marginally higher transient nerve-weakness risk with the retromandibular route, reinforcing that approach selection should be tailored to fracture level rather than applied uniformly.^[29]

Rehabilitation begins on the first postoperative day for surgically treated patients, comprising mirror-guided adduction exercises performed three to five times daily for 5–10 minutes, and at the end of the immobilization period for conservatively treated patients, with most authors recommending that MMF not exceed 10–14 days where

avoidable in order to limit ankylosis risk.^[9]

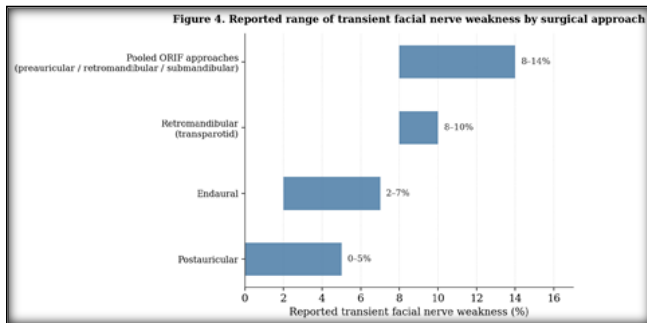


Figure 4: Reported range of transient facial nerve weakness by surgical approach

Complications after Management

Complications following surgical management of condylar fractures are individually infrequent but collectively notable, given how commonly ORIF is now performed³⁶. Thirteen distinct complication categories were quantified across the reviewed literature. [Table 8, Figure 3] Facial nerve damage was the single most frequent complication (8.6% overall: 8.3% transient, 0.3% permanent), followed by hardware-

related complications — breakage or loss of repair material (1.79%) — and salivary complications, namely leakage (1.62%) and fistula (1.11%). Infection (0.60%) and Frey's syndrome / gustatory sweating (0.51%) were less common, while haemorrhage, seroma, sialocele, and acoustic effects each occurred in approximately 0.17% of cases, and condylar resorption, incorrect fragment repositioning, and preauricular hyperaesthesia were each reported at 0.09%.

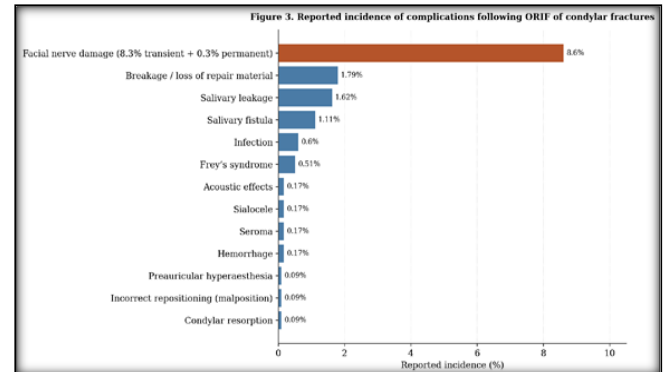


Figure 3: Reported incidence of complications following ORIF of condylar fractures, ranked by frequency

Table 8: Reported complications after closed and open management of condylar fractures

Treatment modality	Reported complication	Frequency / notes
Open reduction and internal fixation (ORIF)	Facial nerve damage	8.6% (8.3% temporary, 0.3% permanent)
	Breakage or loss of repair material	1.79%
	Salivary leakage	1.62%
	Salivary fistula	1.11%
	Infection	0.60%
	Frey's syndrome (gustatory sweating)	0.51%
	Haemorrhage / seroma / sialocele / acoustic effects	0.17% each
	Condylar resorption / incorrect repositioning / preauricular hyperaesthesia	0.09% each
	Inadequate condylar remodeling	3.05% (13/425 cases)
	Malocclusion, TMJ dysfunction	Reported, frequency not separately quantified
Closed reduction		

Facial nerve injury is discussed in greatest depth in the source literature given its clinical and medicolegal significance. Transient weakness occurs in 8–14% of ORIF cases depending on approach, most commonly affecting the marginal mandibular branch via retromandibular or submandibular exposure; permanent paralysis is rare (< 2%) with modern technique.^[23] Injury is graded using Seddon's classification (neuropraxia, axonotmesis, neurotmesis) and clinically using the House–Brackmann scale, and management is stratified from observation and short-course steroids for neuropraxia to nerve grafting or transfer procedures for weakness persisting beyond 6–9 months.^[14] Other notable complications include Frey's syndrome,

arising from aberrant parasympathetic reinnervation of cutaneous sweat glands after auriculotemporal nerve injury, and condylar malposition, which if detected early can often be corrected with guiding elastics but if detected late may require orthognathic correction or joint reconstruction.

Comparative Synthesis: Conservative versus Surgical Management

The core controversy in condylar fracture management is the choice between closed reduction (with MMF and physiotherapy) and ORIF. [Table 9] summarizes the comparative features of each approach as synthesized across the reviewed literature.

Table 9: Conservative versus surgical management — comparative features

Feature	Conservative management (CR/MMF/physiotherapy)	Surgical management (ORIF)
Indication	Non-displaced, paediatric, or bilateral fracture without occlusal derangement	Displaced fracture, loss of ramal height, or failed closed reduction
Advantages	Avoids surgery; no facial-nerve risk; shorter hospital stay	Direct visualization; anatomical reduction; early mobilization
Disadvantages	Risk of malunion, deviation on opening, ankylosis	Surgical complications; facial-nerve risk; visible scar
Facial nerve risk	None	Present (up to 8–14% transient palsy)
Occlusion	May require prolonged MMF	Earlier, more predictable return of occlusion

TMJ dysfunction	Potential long-term risk	Generally reduced via anatomical repositioning
Aesthetics	Possible asymmetry	Better restoration of facial height/symmetry
In children	Preferred, to avoid growth-plate disturbance	Reserved for severely displaced fractures

Of the studies most frequently cited in support of each position, findings were evenly split. [Figure 6] studies by Zide and Kent,^[5] Ellis and Throckmorton,^[8] Terheyden et al,^[9] Al-Moraissi and Ellis,^[23] and Chrcanovic,^[17] were cited in favour of surgical management, reporting superior ramal height, occlusal stability, and range of motion with ORIF; while studies by Silvennoinen et al,^[6] Rowe and Killey,^[2]

Manisali et al,^[7] Valliappan et al,^[21] and Sforza et al,^[15] were cited in favour of conservative management, reporting satisfactory function and adaptive remodeling without surgical morbidity. This even split across influential sources indicates genuine clinical equipoise rather than a resolved question.

Table 10: Controversial points in condylar fracture management

Point of debate	Pro-ORIF view	Pro-conservative view
TMJ ankylosis risk	Anatomical repositioning reduces risk	Risk is minimal with early mobilization
Facial nerve injury	Acceptable risk with a skilled surgeon	Avoided entirely
Growth disturbance in children	Better long-term outcome with surgery in severe cases	Surgery may damage the developing condyle
Symmetry and aesthetics	ORIF better restores ramal height	Acceptable in most cases
Function (range of motion, protrusion)	Early mobilization improves function	Long-term remodeling compensates functionally

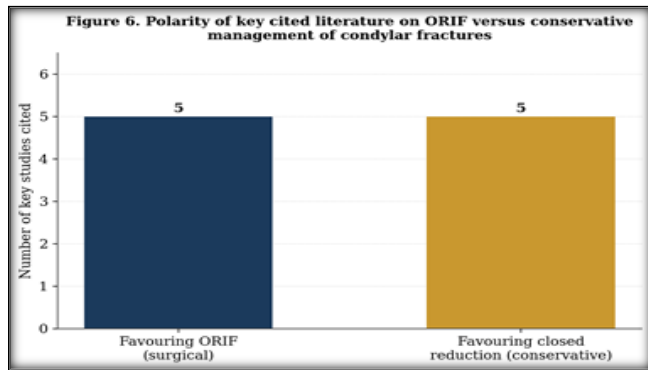


Figure 6: Polarity of key cited literature on ORIF versus conservative management of condylar fractures

Summary of the Reviewed Comparative Literature

The 45 sources underlying this review span 98 years of publication, with a marked concentration of evidence in the last two decades: 11 sources were published in the 2000s, 11 in the 2010s, and 16 from 2020 onward, against only four sources predating 1990 [Figure 5]. This distribution reflects both the growing surgical interest in ORIF since the early

2000s and the recent proliferation of endoscopic, screw-fixation, and digital-planning literature.

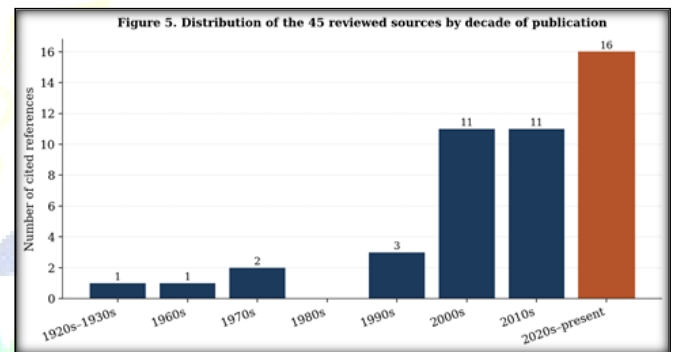


Figure 5: Distribution of the 45 reviewed sources by decade of publication

[Table 11] summarizes the design, focus, and principal finding of the individual comparative and clinical studies reviewed, in chronological order, together with the applicable level of evidence where this could be determined from the source material.

Table 11: Chronological summary of key comparative and clinical studies reviewed

Author(s)	Year	Design / focus	Principal finding	Level
Wassmund	1927/1934	Descriptive classification	Proposed the earliest systematic classification based on displacement and dislocation of the condylar head.	III
Rowe & Killey	1968	Textbook / expert opinion	Advocated closed reduction and functional therapy as the mainstay of treatment, reflecting the surgical caution of the era.	III
Spiessl & Schroll	1972	Classification study	Introduced a structured six-type classification and supported open reduction in selected cases.	III
Lindahl	1977	Radiographic classification	Correlated fracture type and displacement with functional prognosis.	III
Zide & Kent	1990	Expert criteria	Defined the first widely accepted absolute and relative indications for ORIF.	III
Silvennoinen et al.	1994	Clinical outcome study	Reported satisfactory occlusion and mobility with closed treatment, with occasional malocclusion and TMJ dysfunction.	II-2
Manisali et al.	1996	Clinical outcome study	Early mobilization after closed treatment produced better long-term function than prolonged immobilization.	II-2
Ellis & Throckmorton	2005	Comparative study	ORIF more reliably restored ramal height, symmetry, and occlusion than closed treatment, with transient nerve-weakness risk.	II-2
Terheyden et al.	2005	Outcome study	ORIF associated with improved mobility, stable occlusion, and fewer long-term TMJ complications.	II-2

Loukota et al.	2005	Subclassification study	Introduced the “Line A” anatomical reference to standardize fracture-level definition.	III
Haug & Assael	2001	Comparative outcome study	Compared open versus closed treatment outcomes for subcondylar fractures.	II-2
Eckelt et al.	2006	Multicentre study	Evaluated rigid miniplate fixation of condylar base fractures across multiple centres.	II-2
Schneider et al.	2008	Biomechanical study	Compared rigid versus non-rigid fixation constructs for subcondylar fractures.	III
Snyder-Warwick et al.	2010	Systematic review	Pooled data showed transient facial weakness in a notable proportion of ORIF cases, with rare permanent deficits.	I/II
Sforza et al.	2011	3-D CT review	Demonstrated adaptive condylar remodeling in conservatively treated fractures, especially in children.	III
Landes et al.	2012	Randomized controlled trial	Prospective randomized comparison of one versus two miniplates for subcondylar fixation.	I
Chrcanovic	2012	Systematic review	Conservative management favoured in children; ORIF reserved for severely displaced bilateral fractures.	I/II
Feifel et al.	2015	Clinical study	Endoscope-assisted intraoral ORIF achieved outcomes comparable to extraoral approaches with less scarring and nerve risk.	II-2
Bhuria et al.	2016	Systematic review	Endoscopic ORIF comparable to conventional approaches; steep learning curve and longer operative time noted.	I/II
Ying et al.	2017	Classification study	Proposed a disc-displacement and ramus-height based classification with paediatric focus.	III
Valliappan et al.	2019	Comparative clinical study	Open and closed treatment produced similar outcomes in mildly displaced fractures.	II-2
Delay et al.	2019	Clinical study	Cannulated lag screws provided secure fixation and preserved condylar height in head fractures.	II-2
Al-Moraissi & Ellis	2020	Meta-analysis	ORIF superior for mandibular mobility, occlusion, and symmetry in displaced adult fractures; conservative treatment appropriate for minimal displacement and paediatric cases.	I
Silvestrini-Biavati et al.	2020	Clinical study	Functional therapy in paediatric fractures achieved near-normal remodeling without surgery.	II-2
Kumar et al.	2022	Imaging review	CBCT superior for osseous detail; MRI indispensable for disc and soft-tissue assessment.	III
Corre et al.	2023	Systematic review	ORIF provided superior functional outcomes for condylar base fractures, with surgical-morbidity trade-offs.	I/II
Zhao et al.	2023	Prospective PROMs study	ORIF patients reported greater satisfaction in mastication, symmetry, and comfort.	II-2
Joshi et al.	2024	Clinical study	Retromandibular transparotid approach: transient facial paresis in 8–10% of cases, mostly resolving fully.	II-2
Khan	2024	Comparative study	Preauricular approach gave superior visualization; retromandibular gave less visible scarring with slightly higher nerve risk.	II-2
Helmer et al.	2024	Diagnostic study	Multimodal imaging (CT/CBCT/MRI) improves detection of subtle injury and predicts TMD risk.	III
Delay et al.	2025	Prospective study	Headless compression screws offered superior fixation strength versus cannulated screws and miniplates.	II-2
Neff et al.	2021	Clinical study	Headless compression screws provided stable fixation and preserved TMJ function in diacapitular fractures.	II-2

Discussion

Age-Stratified Decision-Making

The results of this review reinforce that condylar fracture management cannot be reduced to a single algorithm applied uniformly across patients. In children, the combination of superior remodeling capacity and the risk of iatrogenic growth-centre injury shifts the balance firmly toward conservative management: Silvestrini-Biavati et al,^[24] and Chrcanovic,^[17] both demonstrated near-normal condylar restitution with functional therapy alone, and the Kaban protocol [Table 5] provides a pragmatic, displacement-stratified framework that keeps immobilization brief enough to avoid ankylosis. In adults, by contrast, the balance of evidence — most clearly articulated in Al-Moraissi and Ellis’s meta-analysis,^[23] — increasingly favours ORIF for displaced or dislocated fractures, where anatomical reduction confers a measurable advantage in ramal height, occlusal stability, and range of motion. Geriatric patients occupy an

intermediate position: reduced bone quality and comorbidity burden argue for conservative management even in some displaced fractures, unless occlusal derangement is severe enough to threaten function or nutrition.

Weighting the Complication Profile

The complication data synthesized in Section 3.6 provide a more granular basis for informed consent than a simple statement that “ORIF carries surgical risk.” Facial nerve weakness, at 8.6% overall, is by far the dominant concern, but the finding that risk varies more than two-fold by approach — from 0–5% with the postauricular route to 8–14% with pooled conventional approaches [Figure 4] — argues for approach selection to be treated as a modifiable risk factor rather than an inherent property of ORIF itself. Equally, the low absolute frequency of hardware failure, salivary complications, and infection (each under 2%) suggests that, once the decision for surgery has been made, technique-related morbidity beyond nerve injury is modest. On the conservative side, the 3.05% rate of inadequate

remodeling after closed reduction, while numerically low, likely understates the true burden of malocclusion and TMJ dysfunction, which were reported qualitatively but not consistently quantified across the reviewed studies — itself a gap worth addressing in future prospective work.

Emerging Technologies and Future Directions

Several innovations are progressively reshaping the surgical envelope. Three-dimensional printing enables patient-specific implants, cutting guides, and anatomical models, improving surgical accuracy and, when paired with virtual surgical planning, allowing plates to be pre-bent and procedures rehearsed preoperatively, even in resource-limited settings.^[40,41] Resorbable fixation systems — polymer- and magnesium-based — are gaining interest as a means of avoiding secondary implant-removal surgery, although they remain biomechanically less stable than titanium and have not yet displaced it as the standard of care.^[43,44] Endoscope-assisted ORIF continues to demonstrate reduced soft-tissue trauma and improved cosmetic outcomes relative to open approaches, at the cost of a steep learning curve,^[18,19] while navigation-assisted surgery offers real-time tracking against preoperative imaging to improve plate positioning accuracy where visualization is limited.^[45] Collectively, these technologies aim to preserve the anatomical advantages of ORIF while progressively reducing its morbidity.

Limitations of the Current Evidence Base

Several limitations temper the strength of the conclusions that can be drawn. First, as detailed in Section 2, this is a narrative rather than a systematic review, and the source material reflects a curated rather than an exhaustively and reproducibly searched literature set; publication bias and selective citation cannot be excluded. Second, the level-of-evidence grading in [Table 11] shows that only a minority of the reviewed comparative studies reached Level I (randomized controlled trial) status — most notably Landes et al,^[16] and the meta-analyses of Al-Moraissi and Ellis,^[23] and Chrcanovic,^[17] — with the majority of evidence deriving from Level II-2 cohort/comparative studies or Level III expert opinion. Third, considerable heterogeneity exists across studies in outcome definitions (for example, “satisfactory function” is not uniformly operationalized), follow-up duration, and fracture classification system used, which limits formal quantitative pooling and is why complication and diagnostic-accuracy data in this review are presented as reported ranges rather than pooled point estimates. Finally, several named sources referenced within the original surgical-approaches literature (relating to postauricular and endaural technique) could not be independently cross-verified against a complete bibliographic record and are therefore presented with appropriate caution.

Conclusion

Condylar fractures constitute a substantial proportion of mandibular fractures, and their management remains one of the most extensively debated topics in maxillofacial trauma

surgery. This review synthesized nine classification systems, comparative diagnostic-accuracy data, seven surgical approaches, and a quantified complication profile spanning thirteen distinct categories, drawn from 45 sources published over nearly a century. No single management strategy emerged as universally superior. Conservative management remains the standard for minimally displaced fractures, for children — where remodeling potential is high and growth-centre preservation is paramount — and for medically compromised patients, while the evidence increasingly supports ORIF for displaced, dislocated, or bilaterally involved fractures in adults, where anatomical reduction confers measurable functional and aesthetic advantages that outweigh a quantifiable but modest risk of facial nerve injury and other surgical morbidity.

Treatment decisions should continue to be individualized on the basis of patient age, fracture level and displacement, occlusal status, associated injuries, and surgeon expertise, rather than governed by a single rule. Continued refinement of fixation systems, wider adoption of minimally invasive and navigation-assisted technique, and — most importantly — further multicentric randomized controlled trials with standardized, validated outcome measures are needed to move the field from the current state of reasoned equipoise toward a more definitive, evidence-based consensus.

References

1. Wassmund M. Klassifikation der Kiefergelenkfrakturen. Arch Klin Chir. 1927;1934.
2. Rowe NL, Killey HC. Fractures of the Facial Skeleton. Edinburgh: Churchill Livingstone; 1968.
3. Spiessl B, Schroll K. Fractures of the condylar process. Int J Oral Surg. 1972;1(1):12–21.
4. Lindahl L. Condylar fractures of the mandible: classification and relation to age, occlusion, and prognosis. Int J Oral Surg. 1977;6(1):12–21.
5. Zide MF, Kent JN. Indications for open reduction of mandibular condyle fractures. J Oral Maxillofac Surg. 1990;41(2):89–98.
6. Silvennoinen U, Iizuka T, Oikarinen K, Lindqvist C. Outcome of closed treatment of mandibular condylar fractures. J Oral Maxillofac Surg. 1994;52(9):873–879.
7. Manisali M, Amin M, Aghabeigi B, Newman L. Conservative management of condylar fractures with early mobilization. Br J Oral Maxillofac Surg. 1996;34(2):103–106.
8. Ellis E, Throckmorton GS. Treatment of mandibular condylar process fractures: biological considerations. J Oral Maxillofac Surg. 2005;63(1):115–134.
9. Terheyden H, et al. Functional results after ORIF of condylar fractures. J Craniomaxillofac Surg. 2005;33(4):235–43.
10. Loukota RA, Eckelt U, De Bont L, Rasse M. Subclassification of fractures of the condylar process of the mandible. Br J Oral Maxillofac Surg. 2005;43(1):72–3.
11. Haug RH, Assael LA. Outcomes of open vs closed treatment of subcondylar fractures. J Oral Maxillofac Surg. 2001;59(4):370–375.
12. Eckelt U, et al. Rigid fixation of condylar base fractures with miniplates: multicenter study. J Oral Maxillofac Surg. 2006;64(1):65–72.
13. Schneider M, et al. Biomechanical analysis of rigid vs non-rigid fixation for subcondylar fractures. J Craniomaxillofac Surg. 2008;36(3):141–146.
14. Snyder-Warwick AK, et al. Facial nerve injury after ORIF of subcondylar fractures: systematic review. Plast Reconstr Surg. 2010;126(6):1911–1919.
15. Sforza C, et al. Mandibular condylar fracture: a review of classifications and biomechanical considerations. Clin Anat.

- 2011;24(3):258–268.
16. Landes CA, et al. Prospective randomized comparison of one vs two miniplates for subcondylar fractures. *Plast Reconstr Surg*. 2012;129(3):345e–357e.
17. Chrcanovic BR. Mandibular condylar fractures in children: a systematic review. *Int J Pediatr Otorhinolaryngol*. 2012;76(3):319–28.
18. Feifel H, et al. Endoscopic-assisted treatment of subcondylar fractures—results and learning curve. *Br J Oral Maxillofac Surg*. 2015;53(4):308–312.
19. Bhutia O, et al. Endoscope-assisted ORIF for subcondylar fractures: systematic review. *J Craniomaxillofac Surg*. 2016;44(6):725–733.
20. Ying B, et al. Classification of condylar head fractures based on disc displacement. *J Craniofac Surg*. 2017;28(3):1–7.
21. Valliappan V, et al. Comparative study of open vs closed management of mildly displaced condylar fractures. *J Oral Maxillofac Surg*. 2019;77(8):1625–1632.
22. Delay A, et al. Use of cannulated screws in condylar head fractures. *J Stomatol Oral Surg*. 2019;120(3):198–205.
23. Al-Moraissi EA, Ellis E. Open versus closed treatment of adult mandibular condylar fractures: a meta-analysis. *J Oral Maxillofac Surg*. 2020;78(6):994–1006.
24. Silvestrini-Biavati A, et al. Functional therapy in pediatric condylar fractures: radiologic outcomes. *Children*. 2020;7(12):301.
25. Kumar I, et al. Imaging of mandibular condyle injuries: CT, CBCT, MRI roles. *Dentomaxillofac Radiol*. 2022;51(4):20210375.
26. Corre P, et al. Condylar base fractures: a systematic review of management. *J Stomatol Oral Maxillofac Surg*. 2023;124(1):101240.
27. Zhao Y, et al. Patient-reported outcomes after ORIF vs closed treatment of condylar fractures: systematic review. *Int J Oral Maxillofac Surg*. 2023;52(8):1015–1026.
28. Joshi S, et al. Facial nerve injury related with retromandibular transparotid approach. *Eur J Oral Surg*. 2024.
29. Khan TA. Comparison of preauricular with retromandibular approach. *Int J Life Sci Pharma Res*. 2024;13(4):709–713.
30. Helmer L, et al. Orofacial trauma and temporomandibular disorders. *Clin Oral Investig*. 2024.
31. Fawzy H, et al. Intraoral vs extraoral approaches for condylar fractures. *Int J Health Res*. 2024.
32. Vijayakumar G, et al. Approach comparison in condylar fracture management: systematic review. *Cuest Fisioterapia*. 2025.
33. Anchlita S, et al. ORIF in condylar head fractures. *J Maxillofac Oral Surg*. 2025.
34. Delay A, et al. Cannulated screw fixation in condylar head fractures. *J Stomatol Oral Surg*. 2025.
35. Neff A, et al. Management of diacapitular fractures with headless compression screws: long-term outcomes. *J Stomatol Oral Maxillofac Surg*. 2021;122(5):493–501.
36. Meyer C, Kahn JL, Boutemi P, Wilk A. Surgical approaches to the mandibular condyle: a comparative anatomic study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2006;102(6):708–713.
37. Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, Teutsch SM, Atkins D. Current methods of the U.S. Preventive Services Task Force: a review of the process. *Am J Prev Med*. 2001;20(suppl 3):21–35.
38. Montazem A, Anastasov GE. Management of condylar fractures. *Atlas Oral Maxillofac Surg Clin North Am*. 2009;17(1):55–69.
39. Vesnaver A, Ahčan U. Evaluation of surgical approaches to the mandibular condyle. *J Craniomaxillofac Surg*. 2005;33:310–317.
40. Javaid M, Haleem A, Singh RP, Suman R. 3D printing applications for the management of complex mandibular fractures: an overview. *J Clin Med*. 2022;11(9):2385.
41. Dawood A, Marti Marti B, Sauret-Jackson V, Darwood A. 3D printing in dentistry. *Br Dent J*. 2015;219(11):521–9.
42. Schepers RH, Raghoobar GM, Vissink A, Stenekes MW, Kraeima J, Witjes MJ. Accuracy of secondary mandibular reconstruction with prefabricated and manually bent reconstruction plates: a clinical trial. *BMC Oral Health*. 2025;25:59.
43. Rehman A, Gupta S, Alam S, Bansal A, Sharma RK. Fixation in maxillofacial surgery—past, present, and future: a narrative review. *J Oral Maxillofac Surg*. 2023;82(1):68–76.
44. Neumann MV, Südkamp NP, Strohm PC. Magnesium-based implants for fracture treatment: a review of the literature. *Acta Biomater*. 2019;98:1–14.
45. Widmann G, Bale R. Accuracy in computer-aided oral and maxillofacial surgery: a review. *Head Face Med*. 2006;2:29.

Copyright: © The author(s), 2026. It is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY-NC 4.0), Creative Commons license that lets people share, remix, and build upon a work, but only for non-commercial purposes and as long as they give credit to the original creator.

How to cite this article: Sharma P, Gupta DS. Controversies in the Management of Mandibular Condylar Fractures: A Narrative Review of Anatomy, Diagnosis, Classification, Treatment Modalities, and Complications. *Asian J. Med. Res*. 2026;15(2):7-16.

Source of Support: Nil, **Conflict of Interest:** None declared.