

Conservative treatment of temporomandibular joint condylar fractures: A systematic review conducted according to PRISMA guidelines and the Cochrane Handbook for Systematic Reviews of Interventions

Giuseppe Minervini^{1,2}  | Rocco Franco³  | Maria Maddalena Marrapodi⁴  |
Marco Di Blasio⁵  | Gaetano Isola⁶  | Marco Cicciù⁶ 

¹Multidisciplinary Department of Medical-Surgical and Odontostomatological Specialties, University of Campania "Luigi Vanvitelli", Naples, Italy

²Faculty of Dentistry, Alexandria University, Alexandria, Egypt

³Department of Biomedicine and Prevention, University of Rome "Tor Vergata", Rome, Italy

⁴Department of Woman, Child and General and Specialist Surgery, University of Campania "Luigi Vanvitelli", Naples, Italy

⁵Department of Medicine and Surgery, University of Parma, University Center of Dentistry, Parma, Italy

⁶Department of Biomedical and Surgical and Biomedical Sciences, Catania University, Catania, Italy

Correspondence

Giuseppe Minervini, Multidisciplinary Department of Medical-Surgical and Odontostomatological Specialties, University of Campania "Luigi Vanvitelli", 80121 Naples, Italy.
Email: giuseppe.minervini@unicampania.it

Abstract

Objective: Fractures of the mandibular condyle are the most common jaw fractures. There are several treatment approaches. There is the non-surgical and surgical approach. The purpose of this systematic literature review is to evaluate the indications and contraindications of either method to help the clinician make the best treatment choice.

Methods: Pubmed, Web of Science and Lilacs were systematically searched until 20 May 2023. Clinical trials were selected to compare the two treatments for condyle fracture and evaluate indications and contraindications.

Results: Out of 2515 papers, four studies were included. The surgical approach allows faster functional recovery and decreases patient discomfort. The study analyses under what circumstances a surgical procedure is more practical than a non-surgical one.

Conclusion: There is no evidence regarding the reliability of either method. Both have superimposable results. However, age, type of occlusion and other factors direct the clinician towards a surgical choice.

KEYWORDS

condylar fracture, conservative treatment, no surgical, non-surgical treatment, surgical treatment, temporomandibular disorders, TMD

1 | INTRODUCTION

Mandibular condyle fractures account for 11%–16% of all face fractures 1–4 and 30%–40% of all mandibular fractures (MFs). The majority are caused less by direct trauma and more by indirect pressures from another blow given to the condyle. Therefore, mandibular condylar fractures (MCFs) are the most overlooked. MCFs have a distinctive position in oral and maxillofacial surgery because, although frequently obtaining positive initial clinical

outcomes, substantial late complications, including discomfort, reduced mandibular mobility, muscle spasm and mandibular deviation, malocclusion, and pathological alterations in the temporomandibular joint (TMJ), including such asymmetry, ankyloses, have been reported.¹ These fractures are treated primarily with surgical and non-surgical techniques (functional). In the past, physiotherapy was followed with maxillomandibular fixation (MMF). MMF united with physiotherapy was the gold standard for treating MCFs without surgery.

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Non-surgical therapy has several advantages over surgical treatment, including lower overall morbidity, risk of ankylosis and avascular necrosis; as for surgical treatment, the occlusal results are more favourable.²⁻⁵ However, long-term side effects can include pain, arthritis, an open bite, a mandibular deviation and inadequate ramus height, resulting in dental ankyloses and malocclusion. Open reduction and internal fixation (ORIF) have become more common surgical techniques due to the development of more efficient materials. The adoption of these techniques by surgeons is spread, especially in severely fractured, misplaced, and dislocated patients, patients without teeth, patients whose ramus has lost height, and situations in which it is difficult to determine the precise occlusion before trauma.⁶ The ORIF method eliminates the need for early MMF release, promotes primary bone healing, decreases treatment time in half and provides reliable three-dimensional reconstruction. Improving nutrition, oral hygiene and respiratory support following treatment reduced MMF necessities.⁷ The ORIF, on the contrary, is extremely difficult; because it is difficult to treat a small area, a fragment is left, resulting in an external scar that may be visible. The procedure is more expensive, requires a more extended stay in the hospital, and increases the chance of wound infection and nerve harm close to arteries like the internal maxillary artery. There has been significant discussion about how best to handle MCFs, namely whether to operate on them or treat them non-operatively.⁸ Moreover, more papers are being published in the current literature comparing surgically treated MCFs to non-invasive approaches.⁹⁻¹⁸ Because theories about treating maxillofacial injuries evolve assessing the various concepts regularly is essential to enhance practices and the possibility of change.¹⁹ This would serve as the foundation for providing the greatest possible treatment. The research aims to determine the criteria and risks for surgical or non-surgical treatment of condylar fractures in adults and children.²⁰ The primary aims in the literature that evaluate the indications for surgical or non-surgical treatment of condylar fractures will be considered.

2 | MATERIALS AND METHODS

2.1 | Eligibility criteria

All documents were assessed for eligibility based on the following Population (including animal species), Intervention, Comparison and Outcomes (PICO):

- (P) Participants consisted of patients with mandibular condylar fractures.
- (I) Intervention consisted of non-surgical treatment of condylar fractures.
- (C) The comparison was to patients treated with surgical treatment of condylar fracture.
- (O) Evaluate the two types of treatment, particularly the indications and contraindications of either treatment in adults or children.

Only papers providing data at the end of the intervention were included. Exclusion criteria were as follows: (1) Studies on patients

TABLE 1 Search strategy.

<i>PubMed</i> ((surgical treatment) OR (non-surgical treatment)) AND (condylar fractures)
<i>Web of Science</i> TITLE-ABS-KEY ((surgical treatment) OR (non-surgical treatment)) AND (condylar fractures)
<i>Lilacs</i> ((surgical treatment) OR (non-surgical treatment)) AND (condylar fractures)

with other mandibular fractures; (2) cross-over study design; (3) studies written in a language different from English; (4) full-text unavailability (i.e., posters and conference abstracts); (5) studies involving animal; (6) review article; (7) case report; and (8) patients treated with other unrecognised methods.

2.2 | Search strategy

The scientific databases were used in the execution of the review (PUBMED, WEB of SCIENCE, LILACS). The electronic search was conducted between 3 January 2000 and 10 April 2023. 'Non-surgical treatment' and 'surgical treatment' have both been used together to describe 'condylar mandibular fractures'. Surgical and non-surgical treatment was linked with the Boolean OR operator, and the AND connector was connected with condylar fractures.

MESH (Medical Subjects Headings) was used to help with the web search (Table 1).

The Cochrane Handbook for Systematic Reviews of Interventions and Preferred Reporting Items for Systematic Reviews (PRISMA) criteria were followed in conducting this systematic review. The systematic review protocol was entered into the International Prospective Register of Systematic Reviews (PROSPERO) under CRD42022373414.

2.3 | Data extraction

Two reviewers (R.F. and G.M.) separately extracted data from the included studies using an individualised data extraction on a Microsoft Excel sheet. A third reviewer was used to obtain consensus in cases of disagreement. The following information was taken out: (1) first author; (2) publication year; (3) type of treatment (surgical or non-surgical); and (4) indications and contraindications.

2.4 | Quality assessment

Using the Cochrane risk-of-bias tool for randomised trials, Version 2, two reviewers evaluated the publications' bias risk (RoB 2). Any discrepancy was handled with a third reviewer until an agreement was obtained.

3 | RESULTS

3.1 | Study characteristics

After searching the three search motors, 2515 articles were selected. Using the exclusion criteria, review and non-English articles were automatically removed via the Boolean operator NOT. Specifically, 17 articles from LILACS, 28 from Web of Science and 329 from PubMed were deleted. In addition, 378 articles were eliminated as duplicates. During the first screening phase, 1763 articles were considered, according to the inclusion criteria of clinical trials and randomised controlled trials, so 1686 articles were excluded. One report was excluded because the full text could not be found. Therefore, 72 articles were published after this screening stage; the abstracts were read to assess eligibility. According to the PRISMA 2020 flowchart in

Figure 1, only four were chosen for this review; a total of 72 articles were excluded: 64 were eliminated because they failed to meet the PICO criteria, and eight were eliminated for failing to meet the inclusion criteria. According to the PICO model, four papers were chosen for title and abstract screening.

3.2 | Main findings

ORIF treated 54 patients with 73 MCFs, whereas the non-surgical group evaluated 26 patients with 29 unilateral and bilateral MCFs. Patients were assessed over 28.5 months after therapy. The two groups' fracture side protrusion and mediotrusion were significantly different, supporting ORIF. Regarding the Helkimo dysfunction score (a primary and rapid test that analyses restrictions of

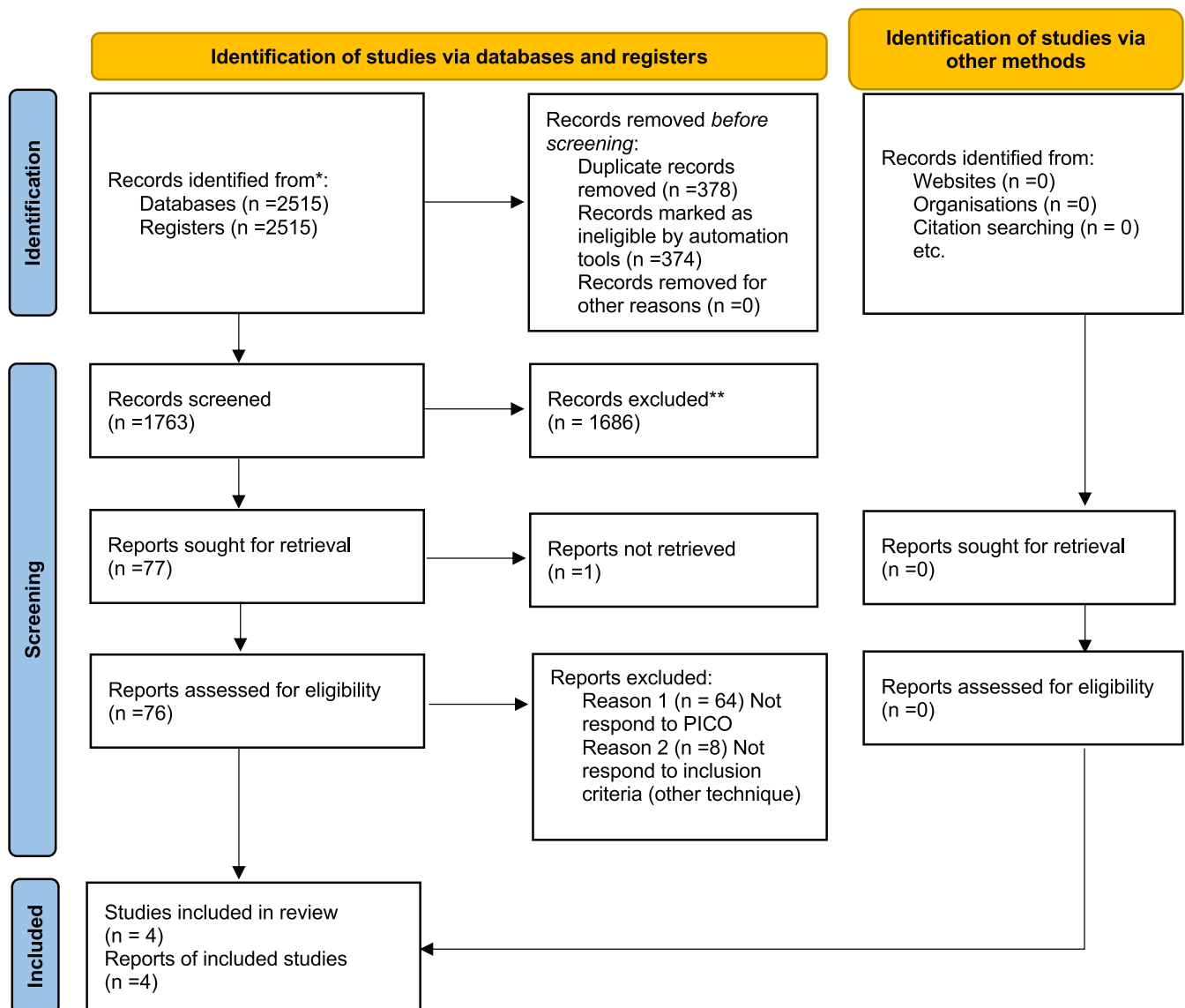


FIGURE 1 Prisma flowchart. Prisma statement. From: Page et al.⁴⁴ For more information, visit: <http://www.prisma-statement.org/> on 24 April 2023.

mandibular mobility, pain and joint function), the ORIF group had statistically more symptom-free individuals than the conservative therapy group. It is possible to confirm associations between the Helkimo dysfunction index and the Angle class and between the number of teeth or the occlusion and pain after a closed reduction (CR) with MMF. The following results were reached after investigating variables potentially significantly impacting CR treatment outcomes. Age seems to be the initial risk factor for reduced motion. A significant connection between age > 25 years and a little protrusion and mediotrusion route was observed in this study ($p = .029$ and $p = .044$, respectively). This was also associated with the Helkimo occlusion index ($p = .045$). The second factor suggesting a less favourable outcome following CR was discovered as an occlusal state. The following results were reached after investigating variables potentially significantly impacting CR treatment outcomes. Age seems to be the initial risk factor for reduced motion. A significant connection between age > 25 years and a little protrusion and mediotrusion route was the number of teeth ($p = .039$), and the Helkimo occlusion index ($p = .034$) was shown to be strongly connected with chronicled pain (GCPS). Furthermore, the Angle class ($p = .001$) impacted the onset of a malfunction (Helkimo DI). In contrast, temporomandibular dysfunction ($p = .046$) and a deep bite ($p = .046$) were associated with vertical loss of the condylar process. There was a trend ($p = .1$) in this study towards a link between female gender ($p = .096$), age ($p = .098$) and chronicled pain (GCPS). Both treatment approaches generally achieved acceptable results based on their previous indications.²¹

The open surgical and non-surgical therapy of individuals with bilateral condylar fractures is examined in this research. Non-surgical and surgical treatment techniques were used in 37 and 18 patients. An average mouth opening was seen in 23 persons (23/37), or 62% of the non-surgical group. The functional success rate in young adult patients (age 29) and older patients (age 30) was 79% (15/19) and 44% (8/18), respectively, with a significant difference between the two groups.²²

Bilateral dislocation and associated mandibular fractures were common in young individuals getting non-surgical treatment. There were no other significant differences between the three (3/7, 43%) older patients and the seven (7/11, 64%) young patients who both restored their standard mouth openness after open surgery. Furthermore, no differentiation was made between non-surgical and surgical therapy in any category. Even though there was no evident difference between the rigid and non-rigid fixation groups, patients recovered the maximal mouth opening in those who received rigid fixation. Men were more abundant in the data than women (69.9%, $p = .0001$). Isolated functional therapy was given to 55 patients (66.26%). Twenty-eight patients (33.7%) used the pre-auricular or modified Risdon's method. The 'operated' group's maximum mouth opening (MMO) was less than the 'non-operated' groups till 6 months (25.75 mm vs 31.96 mm, 34.76 mm vs 37.95 mm, 38.06 mm vs 41.87 mm, respectively, 1, 3 and 6 months, $p = .05$). The outcomes were satisfactory 1 year after therapy (41.29 mm vs 45.22 mm, $p > .05$). Regarding temporomandibular joint dysfunctions, those who underwent surgery and those with non-surgical

treatment did not have differences. In the case of unilateral fractures, operated patients initially lost significantly more ramus height than the 'non-operated' group ($p = .0137$). There was no change between the two sides of the mandible following surgical repair and between the operated and unoperated ramus after the follow-up ($p = .1304$ and $.6420$).²³

This study aimed to see how fast individuals with mandibular condylar process fractures regained mandibular mobility. One hundred sixteen patients (111 males and 25 women) were treated using closed procedures and 62 using an open approach. They were tested to assess how mobile their mandible and condyles were 6 weeks, 6 months, 1 year and 3 years following surgery. Their motion ranges were contrasted with those of 52 controls (26 men and 26 women). The mandibular mobility was evaluated using a jaw-tracking device. Multilevel statistical models were used to assess group differences and forecast the healing pace in fracture patients. Patients with unilateral condylar process fractures frequently showed maximum excursions within 3 years of the fracture, regardless of therapy.

Maximum interincisal opening improved faster in open-treatment patients than in closed-treatment patients (0.43 mm/month vs 0.15 mm/month, respectively). However, part of the difference was due to a markedly decreased opening in open-treatment patients after 6 weeks (38 mm vs 42 mm, respectively). In open-treatment patients, maximum excursion towards the fracture side improved faster than in closed-treatment patients (0.10 mm/month vs 0.04 mm/month, respectively). According to this study, individuals with unilateral condylar process fractures who undergo closed treatment and do not have maxillomandibular fixation but receive physical therapy instruction can be expected to have regular maximal excursions 3 years after treatment. Individuals undergoing open therapy will initially have a less maximal opening, but they may restore normal opening levels sooner than patients undergoing non-surgical treatment (Table 2).²⁴

3.3 | Quality assessment and risk of bias

Using RoB 2, the risk of bias among the analysed studies was estimated and reported in Figure 2. Regarding the randomization process, 100% of the studies ensured a low risk of bias. However, 75% of the studies excluded a performance bias, but 75% reported all outcome data, and 100% of the included studies adequately excluded bias in the selection of reported outcomes, while 50% excluded bias in self-reported outcomes. Overall, only 3 of the four studies were shown to have a low risk of experiencing bias (Figure 2).

4 | DISCUSSION

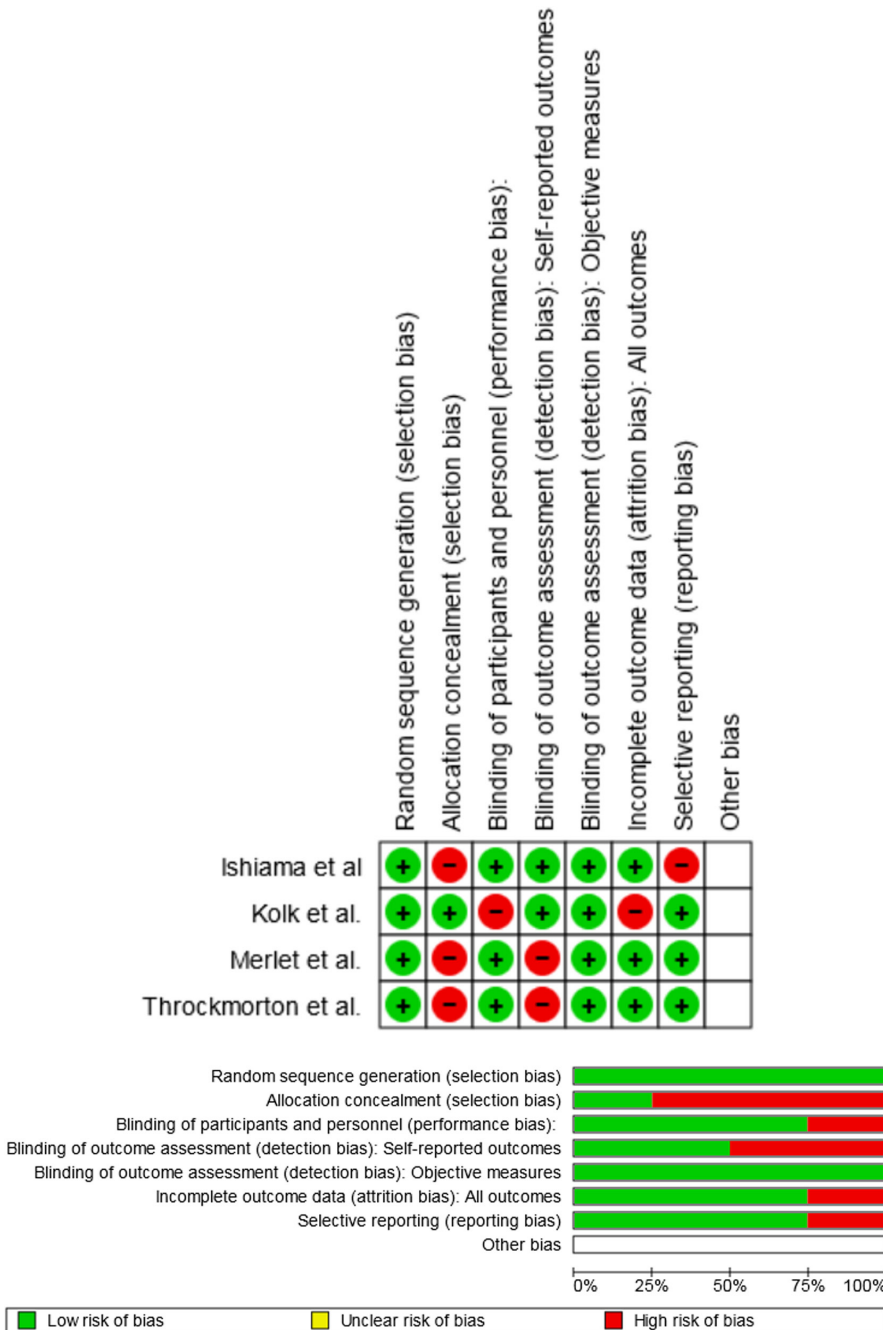
The included studies were of poor quality, with considerable between-study heterogeneity due to significant variances in

TABLE 2 Principal elements of the studies which formed part of the present systematic analysis.

Articles	Years	Type of treatment	Indication, contraindication	Indication and contraindication and results
Kolk et al.	2020	73 condylar fractures threaten with surgery and 29 with no surgery	Longitudinal study. Occlusal status, loss of vertical height, angle class, age	In certain cases, the use of non-surgical treatment reduces complications; however, discomfort and recuro is greater in surgical treatment
Ishiyama et al.	2007	55 patients with condylar fractures 37 non-surgical, 18 surgical	Evaluation of maximum opening, functional success in the two groups	No difference between the two groups
Merlet et al.	2018	83 patients with condylar fractures 55 non-operated 38 operated	Values the maximal opening, temporomandibular joint dysfunction, loss of height of ramus between two groups	The results are similar. In some cases, the surgical approach is preferred
Throckmorton et al.	2000	116 patients with condylar fractures (74 non-surgical, 62 open)	Maximum interincisal opening improved more quickly in patients treated open than in patients treated closed	Maximum excursion towards the fracture side improved more quickly in open-treatment patients than in closed-treatment patients No difference between the maximum opening

research design and a lack of standard definitions. This precluded formal quantitative data synthesis; however, a few critical findings should be illustrated. First, no study showed that ORIF for a condyle fracture was worse, although almost half (45%) of the trials showed statistically significant superiority. Second, facial nerve weakness is infrequent (less than 6% transitory neuropraxia and less than 1% chronic paralysis), and ORIF appears to have low overall morbidity.⁶ Many individuals consider severe overlap and angulation of the proximal segment and the condylar head dislocating beyond the glenoid fossa 'absolute' criteria for ORIF. However, the decision to do ORIF for a condylar fracture is influenced by several variables.^{25,26} The studies included have studied some of them, but most have yet to evaluate critical factors. Patient compliance with postoperative physical therapy and jaw exercises is critical, not only because it impacts outcomes in both CR and ORIF²⁷ but also because dropouts due to noncompliance may artificially bias research. This is especially true for midface fractures due to the need to restore ramus height.²⁶ Unfortunately, this was not reported in half of the studies included, and it might have unexpectedly influenced the investigations' conclusions.²⁸ The same is true for components of patients' medical histories, such as bruxism and past TMJ disorders,²⁹⁻³⁵ which were also underreported in the included study. More than half of the studies did not specify pre-existing temporomandibular joint dysfunction (TMD) as an exclusion criterion.³⁶ Unfortunately, the procedure employed to determine the TMD diagnosis was unclear.^{37,38} As a result, most research focused on postoperative pain. Patients with a history of chronic pain were not included in the inclusion or exclusion criteria. If this is the case, it is unavoidable that the outcomes will have been altered strangely. Furthermore, the complication rates were comparable, especially in postoperative facial nerve paralysis.³⁹ According to the current statistics, many patients who experience temporary facial nerve weakness will fully recover within 6 months, and there is very little chance that they will develop permanent facial nerve weakness.⁴⁰ The total morbidity following ORIF is also not exceptionally high, which is another factor. Although there is little information on how scars occur, most patients find scarring acceptable.⁴¹ Kolk shows that only a few positive prognostic markers, such as isolated MCFs with stable occlusal circumstances in younger patients (25 years), were identified in our study for a long-lasting functional result following CR.⁴² The investigation of Merlet showed that for mandibular condylar fractures caused by articular impact, an isolated available treatment administered appropriately produced clinical outcomes comparable to ORIF. Since adult condylar remodelling is less effective than that in children, surgical intervention should be preferred to restore the height of the ramus.²³ The studies analysed in this review stated that the different open and closed approaches have equal functional recovery in both the adult and the child.⁴³ There are generally recognised (but occasionally overlooked) markers for ORIF. Bilateral displaced fractures, severe dislocations with a loss of vertical ramus height, more than 5 mm, concomitant fractures of other facial areas that limit occlusion and for which MMF of the maxillo-mandibular block will not be practicable, and condyle

FIGURE 2 Risk of bias.



fragment dislocation to the middle cranial fossa are instances of ORIF.^{24,41}

4.1 | Limitations of the study

The limitation of the study relates to the impossibility of conducting a meta-analysis because of the high heterogeneity of the data that could affirm which method (surgical or non-surgical for the treatment of condylar fractures). However, we undertook a critical literature review to evaluate the indications of one or the other method to be applied. From this literature review, we have come

to conclusions that can help clinicians opt for different treatment options.

5 | CONCLUSION

These studies affirm that functional recovery is identity and that the closed approach is better as the patient's discomfort is lower and the risk of nerve injury. However, there is a better recovery regarding malocclusion and lateral deviation. However, if the risk of injury is high, the non-surgical approach causes future occlusion problems.

AUTHOR CONTRIBUTIONS

Giuseppe Minervini: Conceptualization, methodology, software, validation, formal analysis, investigation; data curation, writing—original draft preparation, writing—review and editing, supervision. Rocco Franco: Conceptualization, software, validation, formal analysis. Maria Maddalena Marrapodi: writing—original draft preparation, visualisation. Marco Di Blasio: investigation; data curation. Gaetano Isola: writing—review and editing, supervision. Marco Ciccù: writing—review and editing, supervision. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

All data described in the study are presented in the manuscript. The datasets analysed are available from the corresponding author on reasonable request

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

INFORMED CONSENT STATEMENT

Not applicable.

ORCID

Giuseppe Minervini  <https://orcid.org/0000-0002-8309-1272>

Rocco Franco  <https://orcid.org/0000-0002-2398-7843>

Maria Maddalena Marrapodi  <https://orcid.org/0000-0002-9494-6942>

Marco Di Blasio  <https://orcid.org/0000-0003-2629-9381>

Gaetano Isola  <https://orcid.org/0000-0003-4267-6992>

Marco Ciccù  <https://orcid.org/0000-0003-2311-9728>

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