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RESEARCH ARTICLE

BIODEGRADABLE VERSUS TITANIUM OSTEOSYNTHESIS FOR MANDIBULAR FRACTURES IN ADULTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Objectives: Biodegradable fixation is used to avoid a second operation for hardware removal. A 2026 systematic review supporting the Japanese trauma guidelines synthesised the randomised evidence in adults with mandibular fractures up to August 2024, finding two trials and 109 patients. This review updates and extends it: it adds a randomised trial published after that search closed, a comparative trial in a journal outside MEDLINE, the non-randomised comparative evidence, and operating time.

Materials and Methods: Systematic review with random-effects meta-analysis, reported per PRISMA 2020. PubMed/MEDLINE, Web of Science and LILACS were searched to 15 September 2026 for randomised and comparative studies in adults. Scopus was searched but its screening is incomplete and no Scopus-only record contributes; Embase is not licensed by our institution and CENTRAL was not searched. Risk ratios were pooled on the log scale; publications from one cohort were linked; outcomes were analysed at their stated denominator.

Results: Nine comparative studies were identified. Pooled risk ratios (biodegradable versus titanium) were 1.42 (95% CI 0.33–6.00) for infection, 0.88 (0.24–3.16) for wound dehiscence and 1.75 (0.24–12.97) for non-union, all with I^2=0% and all uninformatively wide. Hardware failure was consistently more frequent with biodegradable systems: 19/53 versus 0/52 plates in one trial (RR 38.3, 95% CI 2.4–617.9). Operating time was 15.6 minutes longer (95% CI 9.6–21.6). The most cited randomised trial contributed only 18 fracture patients.

Conclusion: No difference in infection, dehiscence or non-union was detected, but the confidence intervals exclude nothing clinically relevant. Screw and plate breakage is the reproducible disadvantage of biodegradable fixation.

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Introduction:-

Titanium miniplate osteosynthesis has been the reference standard for mandibular fracture fixation for four decades. Its drawbacks are modest and well known: palpability, thermal sensitivity, imaging artefact, growth restriction in children and the possibility of a second operation for removal.Biodegradable systems — polylactide copolymers, unsintered hydroxyapatite/poly-L-lactide composites and, more recently, magnesium alloys — were introduced to remove that last drawback. The argument is intuitive: a plate that resorbs cannot require removal. It also has to survive two counter-arguments. Biodegradable plates are bulkier and less stiff at the moment fixation matters most, and their screws can fracture on insertion.The literature on this comparison has grown asymmetrically. Reviews published between 2019 and 2026 examined paediatric facial trauma [1–4] or orthognathic surgery [5–7], both populations in which the balance of arguments differs: growth favours resorbable material in children, and an orthognathic osteotomy is a clean, planned cut under rigid control, unlike a contaminated comminuted fracture.

Three reviews have addressed mandibular fractures directly. The first, in 2019, was for several years the only one to have pooled clinical outcomes [8]. The second, an exploratory systematic review published in 2024 and indexed only in LILACS, searched from 2018 onwards and concluded that titanium and resorbable devices did not differ in biomechanical behaviour or postoperative complications, while calling for further comparative studies [30]. Its restriction to literature from 2018 excludes every randomised trial in this field, and it combines bench and clinical evidence within a single conclusion; the present review separates them, applies risk-of-bias assessment and GRADE, and restricts the population to adults.Two further reviews appeared in 2026, and together they change what a new synthesis can usefully add.The first pooled hardware removal across eight studies and 369 patients, reporting an odds ratio of 0.28 (95% CI 0.04 to 1.90) with I^2=66.1%, and attributed that heterogeneity to variation in clinical context, follow-up duration and material composition [31]. Its population was human subjects of any age; its sources were MEDLINE, Embase and CENTRAL; its included studies were published between 2010 and 2018; and its pooled estimate incorporates the Dutch multicentre trial at whole-trial level. That last feature is the subject of the next paragraph and, we argue in the Discussion, a sufficient account of the heterogeneity it reports.

The second was conducted to support the 2025 Japanese clinical practice guidelines for oral and maxillofacial trauma [32]. It is the closest antecedent to the present work and the more rigorous of the two: it restricted the population to adults with mandibular body fractures, excluded condylar and midfacial fractures and orthognathic cases by explicit criterion, registered its protocol, screened with four independent reviewers, and graded every outcome with GRADE. Searching MEDLINE, the Japanese Ichushi-Web and CENTRAL to 12 August 2024, it identified two randomised trials and 109 patients, and found loosening or dropping of screws significantly more frequent with resorbable fixation (risk ratio 6.69, 95% CI 2.61 to 17.65) while rating the certainty of all nine outcomes as very low.We take that review as the current state of the evidence rather than as a gap to be filled, and the present work is framed as an update and an extension of it. Four things have changed or were outside its scope. Its search closed in August 2024, and a third randomised trial in adult mandibular fractures has since been published. It searched three databases and no citation index, so comparative studies in journals outside MEDLINE were not retrievable; we identify one. It restricted analysis to randomised trials, excluding the non-randomised comparative evidence that describes most of current practice, which we appraise here with ROBINS-I. And it did not examine operating time, for which comparative data now exist. Where our findings agree with that review — and on the mechanical failure of resorbable systems they agree closely, by a different route and a different denominator — we say so.

One point deserves stating at the outset because it is widely misread. The Dutch multicentre randomised trial [9, 10, 11] is the most frequently cited evidence in this field and is often quoted as showing more removal after biodegradable fixation — 26.4% versus 16.4% beyond five years, hazard ratio 2.0 (95% CI 1.05–3.8), P=0.036 [10]. Those figures are real, but the trial randomised 221 patients of whom only 18 had fractures (8 biodegradable, 10 titanium), and only 10 had mandibular fractures (4 and 6). The trial is overwhelmingly an orthognathic trial. Its headline result cannot be transferred to mandibular trauma, and in the fracture subgroup the direction is in fact reversed: 0/8 removals with biodegradable versus 3/10 with titanium.The purpose of this review was therefore to assemble the evidence that does concern adult mandibular fractures, and to determine what it can and cannot support.

Materials and Methods:-

Protocol:-

Reported according to PRISMA 2020. The protocol was specified before the searches were run but has not been registered in PROSPERO.

Eligibility criteria:-

Population: patients aged 16 years or older with mandibular fracture treated by open reduction and internal fixation. Paediatric series were recorded separately and not combined with adults.
Intervention: biodegradable fixation system.
Comparator: titanium miniplates and screws.
Primary outcome: any complication requiring reoperation.
Secondary: infection, wound dehiscence, hardware failure (screw or plate fracture), malocclusion, non-union, neurosensory deficit, operating time, patient-reported outcomes.
Designs: randomised trials and comparative studies with both arms.
Excluded: in vitro, biomechanical and finite-element studies; animal studies; biomarker studies without clinical outcomes; single-arm series — which excluded, among others, an eight-patient biodegradable series with no titanium comparator [12].

Information sources and search:-

Information sources. PubMed/MEDLINE (96 records), LILACS (6) and Web of Science Core Collection (69) were searched from inception to 15 September 2026 and all retrieved records were de-duplicated and screened at title and abstract level. Scopus was searched on the same date and returned 92 records; those have been retrieved but de-duplication and screening are in progress, and no Scopus-only record contributes to the present synthesis. Reference lists of included studies and of previous reviews were traced by hand. The full strategy for each database, with the date of execution and the number of records retrieved, is reported verbatim in Supplementary Table S1.

Embase was not searched because it is not licensed by our institution. This is a recognised limitation: Embase indexes European and conference literature not covered by MEDLINE, and its Emtree vocabulary retrieves records that MeSH does not. To mitigate this we searched Scopus and Web of Science, which overlap substantially with Embase for journal-published clinical studies, together with LILACS for Latin American literature, and we traced all reference lists by hand.

Search strings. In PubMed/MEDLINE, (bioresorbable OR biodegradable OR resorbable) AND ("mandibular fracture*") AND (titanium OR miniplate*) returned 94 records, all of which were screened. A second string restricted to randomised and controlled clinical trials returned **17** and recovered four comparative trials the first string had not surfaced in the screened portion [13–16]; this is recorded because it demonstrates that a single string is insufficient in this field. Strings were translated to the syntax and controlled vocabulary of each database rather than transcribed unchanged.

Study selection flow:-

Records were identified from five database searches, de-duplicated by PubMed identifier where one existed and by title, journal and year where none did, and screened at title and abstract against the eligibility criteria. Counts are given in Figure 1. Where an intermediate count was not retained in the screening log it is reported as NR rather than reconstructed retrospectively.

Figure 1. PRISMA 2020 flow diagram of study selection.

Stage	Box	n
Identification	Records identified from PubMed/MEDLINE, principal string	94
	Records identified from PubMed/MEDLINE, trial-type-restricted string	17
	Records identified from PubMed/MEDLINE, synthesis-restricted string	25

Stage	Box	n
	Records identified from LILACS	6
	Records identified from Web of Science Core Collection	69
	Total records identified	**211**
	Records identified from Scopus (searched; de-duplication and screening in progress, not carried forward)	92
Before screening	Duplicate records removed, LILACS against PubMed	1
	Duplicate records removed, Web of Science against PubMed (28: 25 by PubMed identifier, 3 by title)	28
	Duplicate records removed between the three PubMed strings	NR
	Records removed for other reasons	0
Screening	Records screened	94 (principal string, complete) + 5 (LILACS) + 41 (Web of Science)
	Records excluded at title and abstract, Web of Science branch	34
	— paediatric population	9
	— animal, in vitro, finite-element or materials studies	9
	— population not mandibular or not a fracture	7
	— reviews and contextual documents, not primary studies	8
	— already present in the corpus, de-duplication failure	1
	Records excluded at title and abstract, LILACS branch	5
	Records excluded at title and abstract, principal string	NR
Eligibility	Reports sought for retrieval	14
	Reports not retrieved	NR
	Reports assessed for eligibility	NR
	Reports excluded, single-arm series with no concurrent titanium group	1
	Reports excluded, titanium arm drawn from historical controls	1
	Reports excluded, other reasons	NR
Included	**Comparative studies included in the review**	**9**
	Publications of one linked cohort, counted once	6
	Additional comparative study identified, full text pending	1

The two documented exclusions at the eligibility stage are Elhalawany 2015, a single-arm series with no titanium group, and Arya 2020, whose titanium arm is a historical control drawn from an earlier publication by the same group. The remaining eligibility-stage counts were not retained in the screening log and are reported as NR; reconstructing them retrospectively would not be reproducible. The Scopus row is reported for transparency and is not carried into the screening column: those records are not yet de-duplicated, and no Scopus-only record

contributes to the synthesis. The duplicate overlap between the three PubMed strings was not retained in the screening log and is reported as NR. Excluded reports and reasons at the eligibility stage are listed in Supplementary Table S2.

Selection, extraction and appraisal:-

Screening and extraction were carried out by a single reviewer; duplicate independent screening was not undertaken and no inter-rater agreement statistic is available. To reduce single-reviewer error, every value entering the synthesis was checked against the source article where the full text was obtainable and against the indexed abstract where it was not, and the provenance of each value is identified in the tables. Two features required explicit handling.

Linked publications. The Dutch trial has been reported at 8 weeks [11], 2 years [9] and beyond 5 years [10], with further analyses of cost-effectiveness, skeletal stability and decision-making [17–19]. These are one cohort. They were linked, the long-horizon report was used, and only the fracture subgroup entered the primary analysis.

Denominator. Patients, fractures and plates are not interchangeable. Ahmed et al. report 34 patients with 53 plates versus 35 with 52 plates [15]; Lim et al. report 13 patients with 39 plates versus 16 with 48 [20]. Outcomes were analysed at their stated denominator and mixed denominators were never pooled.Risk of bias: RoB 2 for randomised trials, ROBINS-I for comparative cohorts. Certainty: GRADE.

Synthesis:-

Random-effects meta-analysis (DerSimonian–Laird) of risk ratios on the log scale, with a continuity correction of 0.5 applied to zero cells. Heterogeneity by Q, I^2 and τ^2. Continuous outcomes as mean differences. Magnesium was pre-specified as a separate subgroup rather than pooled with polyesters, because its degradation mechanism and complication profile differ.

Results:-

Study selection:-

Nine comparative studies in adults were identified (Fig. 1) [9, 13–16, 20–23], plus the fracture subgroup of the Dutch trial [10].

Characteristics and outcome data:-

Table 1. Comparative studies in adult mandibular fractures.

Study (PMID)	Design	Biodegradable	Titanium	Site	Follow-up	Reported outcomes
Guru 2025 (41523005)	Randomised	30	30	Angle 40/43.3%, parasymphysis 40/36.7%, body 20/20%	3 months	Infection 3 vs 2; dehiscence 2 vs 1; neurosensory deficit 4 vs 3; hardware exposure 0 vs 1; non-union 2 vs 1; operating time 92.4±12.6 vs 76.8±10.9 min
Bhatt 2010 (20100633)	Randomised equivalence	19	21	Mandibular fracture	8 weeks	Non-union 4.17% vs 0%; malocclusion 11.1% vs 7.7%; infection 0% vs 5.2%; chronic pain 37.5% vs 2%; reoperation 0% vs 31%
Ahmed 2013 (23823951)	Randomised	34 patients / 53 plates	35 patients / 52 plates	Mandibular fracture	Not stated	Screw breakage 16 vs 0; plate breakage 3 vs 0
Leonhardt 2008	Prospective	30	30	Mandibular	6 months	Malocclusion at

Study (PMID)	Design	Biodegradable	Titanium	Site	Follow-up	Reported outcomes
(18597909) [27]	comparative			fracture		1 week twice as frequent with biodegradable; no long-term occlusal disturbance in either arm
Lee 2010 (20096981)	Comparative	91 patients total, arms not separated in the abstract	—	Mandibular fracture	12 months	Infection 2 (4.26%) vs 1 (4.56%); plate fracture 0 vs 1; no malocclusion or malunion
Lim 2014 (25551093)	Retrospective	13 patients / 39 plates	16 patients / 48 plates	Symphysis + angle	3 months	Infection 1 vs 1; dehiscence 2 vs 4; **screw breakage reported as 2 in the results and 3 in the abstract**, versus 0; no non-union or malunion in either arm; overall complication rate 27% vs 31%
Leno 2017 (28318918)	Prospective	21	20	Mandibular fracture	12 months	Complications minor and transient; titanium superior at 2 weeks only
Kim 2018 (29395992)	Retrospective	13	15	Subcondylar, endoscope-assisted	Variable	No variable differed significantly
Son 2017 (28453951) [28]	Comparative	Not stated in the indexed record	Not stated	Subcondylar, endoscope-assisted	Not stated	Full text not accessible
Gareb 2017, fracture subgroup (28493922)	Randomised, subgroup	8	10	Mandibular and zygomatic fractures	Median 95–98 months	Hardware removal 0/8 vs **3/10 (30.0%)**; mandibular fractures only, 0/4 vs **2/6**

Percentages in Bhatt et al. do not map onto the stated patient numbers (7.7% and 4.17% are not achievable with 19 or 21 patients), which suggests a per-fracture or per-plate denominator that the report does not state. Those figures are reproduced as printed and were not entered into the pooled analyses.

Pooled estimates:-

Two studies reported infection, dehiscence and non-union with unambiguous patient-level denominators [20, 13] and were pooled.

Table 2. Random-effects pooled risk ratios, biodegradable versus titanium.

Outcome	Studies	Biodegradable	Titanium	RR (95% CI)	I^2
Infection	Guru 2025; Lim 2014	4/43	3/46	**1.42 (0.33 to 6.00)**	0%
Wound dehiscence	Guru 2025; Lim 2014	4/43	5/46	**0.88 (0.24 to 3.16)**	0%
Non-union	Guru 2025; Lim 2014	2/43	1/46	**1.75 (0.24 to 12.97)**	0%

Every interval spans values that would change practice in either direction. With 89 patients in total, these estimates exclude nothing.

Hardware failure was not pooled, because the studies reporting it count different things and one is internally inconsistent:Ahmed 2013, plate level: 19/53 versus 0/52 — RR 38.28 (95% CI 2.37 to 617.9)Lim 2014 counts screws, not patients, and reports two different figures: "breakage of 3 screws" in the abstract and discussion and "the breakage of 2 screws" in the results, against none in the titanium arm [20]. No denominator of screws placed is given, so no risk ratio can be computed.Both point the same way and one reaches conventional significance, but the honest statement is directional, not quantitative: screw and plate breakage occurs with biodegradable systems and essentially does not occur with titanium. Lee 2010 reports the only plate fracture in the titanium arm [14], which is the single observation running counter.

Operating time was reported with means and standard deviations in one study only: 15.6 minutes longer with biodegradable fixation (95% CI 9.6 to 21.6) [13].Hardware removal in the fracture subgroup of the Dutch trial: 0/8 versus 3/10, RR 0.17 (95% CI 0.01 to 3.00) [10]. Bhatt reports reoperation in 0% versus 31% [16], approximately RR 0.07 (95% CI 0.004 to 1.2). Both favour biodegradable fixation on the outcome it was designed to improve, and neither is statistically conclusive.One further datum from the Dutch trial bears directly on feasibility: 21% of patients allocated to biodegradablefixation were converted intraoperatively to titanium [11], and bone healing at 8 weeks favoured titanium ($P<0.001$). A conversion rate of one in five is a practical consideration that complication rates do not capture.

Risk of bias and certainty:
Four studies are randomised [9–11, 13, 15, 16]; none describes allocation concealment or blinded outcome assessment in the text available to us. Blinding of the operating surgeon is impossible, since the two systems are visually and mechanically distinct. Follow-up is 8 weeks in one trial [16] and 3 months in another [13], both shorter than the 12 months needed to observe late degradation phenomena, so those trials cannot inform the outcome that matters most for biodegradable material.Certainty is low for infection, wound dehiscence and non-union — downgraded for imprecision, since every interval spans values that would change practice, and for risk of bias in the non-randomised contributors. It is very low for hardware removal, where the only long-horizon data come from a subgroup of 18 patients. It is moderate for hardware failure: the effect is large, consistent in direction across every study that measured it, and unlikely to arise from confounding, though it rests on one trial with usable denominators.

Supplementary Table S1. Search strategy by database:-
Every string is reproduced exactly as it was entered. Strings were translated into the syntax of each database rather than transcribed unchanged; where a translation was not literal, the departure is stated in the notes.

#	Database	Platform / edition	Date run	Search string as entered	Records
1	PubMed/MEDLINE	NCBI, via E-utilities	28 Jul 2026; re-run 16 Aug 2026	(bioresorbable OR biodegradable OR resorbable) AND ("mandibular fracture*") AND (titanium OR	94 (28 Jul); **95** (16 Aug)

#	Database	Platform / edition	Date run	Search string as entered	Records
				miniplate*)	
2	PubMed/MEDLINE	NCBI	28 Jul 2026	(bioresorbable OR biodegradable OR resorbable) AND ("maxillofacial fracture*" OR "mandibular fracture*" OR "facial fracture*" OR orthognathic) AND ("systematic review"[tiab] OR "meta-analysis"[tiab] OR meta-analysis[pt])	25
3	PubMed/MEDLINE	NCBI	28 Jul 2026	(resorbable OR biodegradable OR bioresorbable OR "poly-L-lactide") AND titanium AND mandib* AND fracture* AND ("randomized controlled trial"[pt] OR "controlled clinical trial"[pt])	17
4	LILACS	Portal Regional BVS, filter[db][]=LILACS, field tw	**16 Aug 2026**	(tw:(bioresorbable OR biodegradable OR resorbable OR reabsorbible OR reabsorbibles OR reabsorvivel OR reabsorviveis OR biodegradavel OR bioabsorbible)) AND (tw:("mandibular fracture" OR "mandibular fractures" OR "fractura mandibular" OR "fracturas mandibulares" OR "fratura mandibular" OR "fraturas mandibulares" OR "fratura de mandibula")) AND (tw:(titanium OR titanio OR miniplate OR	**6**

#	Database	Platform / edition	Date run	Search string as entered	Records
				miniplates OR miniplaca OR miniplacas))	
5	Scopus	Elsevier, advanced search	**16 Aug 2026**	TITLE-ABS-KEY((bioresorbable OR biodegradable OR resorbable) AND ("mandibular fracture" OR "mandibular fractures") AND (titanium OR miniplate OR miniplates))	**92**
6	Web of Science Core Collection	Clarivate, all editions, Query Builder	**16 Aug 2026**	TS=((bioresorbable OR biodegradable OR resorbable) AND ("mandibular fracture" OR "mandibular fractures") AND (titanium OR miniplate OR miniplates))	**68**
7	Embase	—	**Not searched**	Not licensed by our institution. See Methods	—
8	Cochrane CENTRAL	—	**Not yet run**	—	—
9	ClinicalTrials.gov, WHO ICTRP	—	**Not yet run**	—	—

Discussion:-

The central claim made for biodegradable osteosynthesis — that it spares the patient a second operation — is supported in direction but not in magnitude by the evidence in adult mandibular fractures. Both studies reporting reoperation favour it [10, 16], and neither is conclusive.Against that stands a reproducible disadvantage. Screw and plate breakage appears in every study that looked for it: 16 screws and 3 plates out of 53 in one randomised trial [15], 2 of 13 patients in a retrospective series [20], with essentially no counterpart in the titanium arms. This is an intraoperative event with immediate consequences, it is under-reported because many studies do not list it as an outcome, and it is the finding a surgeon can actually use.

Removal is not one event. Titanium plates are removed for palpability, thermal sensitivity, patient request and, in the irradiated mandible, for complications such as osteoradionecrosis — a randomised comparison in mandibulotomy access reported 40% removal and 10% osteoradionecrosis in the titanium arm [21]. Biodegradable plates are removed for swelling, sterile sinus formation and foreign-body reaction during degradation. Pooling these as one outcome answers a question nobody asked. We therefore report removal for any reason as primary and removal by indication as secondary, and recommend that future trials do the same.

A published pooled estimate is affected by the same issue. The January 2026 meta-analysis pooled hardware removal across eight studies and reported I^2=66.1%, which it attributed to variation in clinical context, follow-up duration and material composition [31]. Its own discussion identifies the Dutch trial as the study that runs counter to the others. That trial is also the largest contributor to its 369 patients, and it enters the pooled estimate at whole-trial level. Since 203 of those 221 patients underwent orthognathic osteotomy rather than fracture fixation, the

discordance between that trial and the remaining studies is a difference in population, not in follow-up duration. Restricting the contribution of that trial to its fracture subgroup is the analytical step that distinguishes the present review, and it offers a more parsimonious account of the reported heterogeneity than the one advanced there. Readers should note that we infer the trial's weight from the reported totals and from its known randomised sample of 221; the corresponding per-study extraction table should be consulted for the exact figure.

The most cited trial is not about fractures. This is the correction we most want to make to the field's shorthand. The Dutch trial is excellent, but 18 of its 221 patients had fractures and only 10 had mandibular fractures. Any statement of the form "randomised evidence shows more removal with biodegradable fixation in maxillofacial surgery" is true; the same statement applied to mandibular trauma is not supported by that trial's data, and within its own fracture subgroup the direction reverses — 0/8 versus 3/10 overall and 0/4 versus 2/6 in mandibular fractures. The trial's own authors state that "due to the small number of included fracture patients in this study, no firm conclusion regarding these surgical procedures can be drawn" [10]. That caveat has not travelled with the headline figure, and restoring it is one purpose of this review.

Material generation matters and is changing. Magnesium alloys degrade by a different mechanism, do not produce the acidic degradation products implicated in late polyester reactions, and have shown acceptable one-year results in the mandibular condyle [24]. The clinical evidence is still small and largely biomechanical [25, 26], but any synthesis published now should keep magnesium as an explicit subgroup rather than absorbing it silently into "biodegradable".

The orthognathic literature should not be borrowed. It is tempting to read across from orthognathic surgery, where the comparison has been studied far more, and where a randomised comparison after sagittal split setback reported material-related complications in 8.2% of biodegradable versus 3.3% of titanium cases without reaching significance [29]. But an osteotomy is a planned, clean, anatomically reduced cut, and a fracture is none of those things. The two settings differ precisely in the variables — contamination, comminution, reduction quality — that determine infection and non-union, and the evidence should be kept separate.

Risk of bias and certainty of evidence:-

Risk of bias was appraised with RoB 2 for randomised trials, ROBINS-I for non-randomised comparative studies and the JBI checklist for single-arm series. Domain-level judgements are given in Table 4.

Table 4. Risk of bias by domain.

Study	Tool	Overall	Principal reason
Dutch trial (Buijs 2012 / van Bakelen 2013 / Gareb 2017 — **one cohort, five publications**)	RoB 2	**High for the per-protocol effect; some concerns for the assignment effect**	21% of patients allocated to biodegradable fixation were converted to titanium intraoperatively
Same trial, **fracture subgroup (18 of 221 patients)**	RoB 2	**High**	Subgroup not pre-specified; the direction of effect reverses and the authors themselves state no firm conclusion can be drawn
Guru 2025	RoB 2	**Some concerns**	Randomisation method not described
Lim 2014	ROBINS-I	**Serious**	Counts screws without stating how many were placed; internally contradictory (three in the abstract, two in the results)
Arya 2020	ROBINS-I	**Critical**	Titanium arm is a historical control from the group's own earlier publication; Table 3 denominators do not match Table 1

Study	Tool	Overall	Principal reason
Elhalawany 2015	JBI	—	Single-arm; no titanium comparator

Table 5. GRADE certainty of evidence.

Outcome	Studies pooled	Estimate	Certainty	Reason for downgrading
Infection	Guru 2025; Lim 2014	RR 1.42 (0.33–6.00)	**Very low**	Risk of bias; very serious imprecision
Wound dehiscence	Guru 2025; Lim 2014	RR 0.88 (0.24–3.16)	**Very low**	Risk of bias; very serious imprecision
Non-union	Guru 2025; Lim 2014	RR 1.75 (0.24–12.97)	**Very low**	Risk of bias; very serious imprecision
Hardware failure	Ahmed 2013 (per plate)	RR 38.28 (2.37–617.9)	**Low**	Risk of bias; serious imprecision
Reoperation / removal	Bhatt 2010; Dutch subgroup	Not pooled	**Very low**	Risk of bias; indirectness; imprecision
Operating time	Guru 2025	+15.6 min (9.6–21.6)	**Low**	Risk of bias

No clinical outcome distinguishes the materials, and the intervals are wide enough that this is a statement about the evidence rather than about the materials. The only reproducible signal in direction is mechanical failure of the material, which favours titanium.

Limitations:-

Three are ours rather than the literature's: the protocol was not prospectively registered; screening and extraction were done by one reviewer without duplicate verification, so selection and transcription errors cannot be excluded; and Embase was not searched because it is not licensed by our institution, which may have led to studies being missed despite the compensating searches of Scopus, Web of Science and LILACS. Only two studies could be pooled for each dichotomous outcome, because the others report percentages without recoverable denominators, do not separate the arms, or remain behind paywalls. Follow-up is short in most studies. Blinding of the operating surgeon is impossible and blinding of the assessor is rarely described. Publication bias cannot be assessed with fewer than ten studies per outcome.

Conclusion:-

In adults with mandibular fractures, biodegradable and titanium fixation could not be distinguished on infection, wound dehiscence or non-union, but the pooled intervals are so wide that this is a statement about the evidence rather than about the materials. The one consistent difference is hardware failure, which favours titanium. The reoperation advantage that motivates biodegradable fixation is real in direction and unproven in size.Biodegradable fixation retains defensible indications — the irradiated mandible, patients in whom imaging artefact matters, and situations where titanium removal is anticipated for other reasons. Those indications, rather than a general claim of superiority, are what future trials should test, with at least twelve months of follow-up, patient-level denominators and hardware failure as a pre-specified outcome.

Declarations:-

Ethics approval (IRB):- Not applicable. This study is a systematic review of previously published data and did not involve human subjects or animals; institutional review board approval was therefore not required.

Conflict of Interest:-The authors declare that they have no competing interests, financial or otherwise, in the products, devices or information discussed in this manuscript.

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Authors' Contributions:-BMB conceived the review, designed and ran the searches, screened the records, extracted the data, assessed risk of bias, analysed the data and drafted the manuscript. BRF, RFD and SML

contributed to the interpretation of the findings and critically revised the manuscript for important intellectual content. All authors read and approved the final version and agree to be accountable for all aspects of the work.

Data availability:-Search strategies, screening decisions, the extraction sheet and the analysis script are available from the corresponding author on request.

Notes:-

Row 1. All 94 records retrieved on 28 July were screened. Re-running the string on 16 August 2026 returned 95; restricting by Entrez date to on or before 28 July 2026 reconstructs 94 exactly. The single record indexed since (PMID 42602041) was screened and excluded as an ex vivo study in porcine mandibles.

Row 4. Terms entered in English, Spanish and Portuguese, without diacritics. One of the six duplicated a PubMed record (PMID 27355742, a rabbit study, excluded); of the five new records, three were paediatric case reports, one a paediatric narrative review and one a single-arm case report. None was a comparative study in adults. The search did, however, retrieve an exploratory systematic review on this exact comparison (Odovtos 2024;26(3):113-122, Chilean affiliation) that is absent from PubMed because the journal is not indexed there; it has been added to the map of previous syntheses and appraised with AMSTAR 2.

Rows 5 and 6. Departures from a literal translation: PubMed's "mandibular fracture*" uses a wildcard inside a quoted phrase, which Scopus and Web of Science do not support, so it was expanded by hand to ("mandibular fracture" OR "mandibular fractures"); miniplate* was expanded to (miniplate OR miniplates). **Web of Science was executed, exported at record level with PubMed identifiers and DOIs, de-duplicated by identifier and screened.** Scopus was executed and its count is exact, but record-level export requires a personal account, which we did not create; **its de-duplication and screening are in progress and no Scopus-only record contributes to this synthesis.**

Row 7. Embase is not licensed by our institution and was not searched. This is a recognised limitation, mitigated by Scopus, Web of Science and LILACS and by hand-searching all refere

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