Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 1193-1200 | ISSN:2251-6727

Comparing the Effect of Osseodensification Technique Versus Conventional Technique on Primary Stability of Implant in Low Density Bone: A Systematic Review

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(Received: 16 January 2026 Revised: 25 February 2026 Accepted: 17 March 2026)

KEYWORDS

Osseodensification; Conventional drilling; Primary implant stability; Insertion torque; Implant stability quotient (ISQ); Bone density; Osteotomy preparation; Dental implants; Marginal bone loss; Implant biomechanics.

ABSTRACT:

Primary implant stability plays a crucial role in successful osseointegration and long-term implant survival. Conventional drilling removes bone during osteotomy, which can reduce bone density and compromise initial stability, especially in low-density bone. Osseodensification (OD), a non-subtractive drilling technique, aims to compact bone, maintain the natural trabecular structure, and enhance mechanical engagement of implants.

This systematic review compares the effectiveness of OD with conventional drilling in achieving primary stability in low-density bone. A comprehensive literature search was conducted according to PRISMA guidelines using PubMed, Scopus, Web of Science, Embase, Cochrane Library, and Google Scholar up to January 2025. Included studies directly compared OD and conventional techniques, evaluating outcomes such as insertion torque, implant stability quotient (ISQ), removal torque, marginal bone levels, and bone density. A total of fourteen studies met the inclusion criteria.

Results across clinical, ex vivo, animal, and review studies consistently showed that OD improves insertion torque, ISQ, bone density, and mechanical engagement compared with conventional drilling. Clinical studies also noted reduced early marginal bone loss and better short-term peri-implant stability. Advantages were most evident in low-density bone, ridge-split cases, and immediate implant placements.

In conclusion, osseodensification is a minimally invasive approach that enhances primary stability and preserves peri-implant bone. While current evidence is promising, variability among study methods underscores the need for high-quality randomized clinical trials using standardized protocols to confirm its long-term clinical benefits.

1. Introduction

It is commonly accepted that primary implant stability represents the crucial biomechanical factor that basically determines the predictability of osseointegration and the long-term survival of dental implants. The way the osteotomy is carried out essentially impacts the degree of the implant thread's mechanical engagement with the bone that is around. Conventional osteotomy procedures are based on subtractive drilling that takes away bone to make room for the implant. In short, by means of this subtraction, the local bone density might be lowered, thermal risk increased, and consequently the quality of primary stabilization might be reduced, especially in low-density bone areas like the posterior maxilla [1,2].

One of the key developments in the preparatory procedure for osteotomy is the introduction of osseodensification, a non-subtractive drilling concept, which preserves and compacts the bone by controlled plastic deformation. The technique uses specially designed densifying burs for the lateral compaction of trabecular bone thus, allowing autogenous bone retention, increased osteotomy wall density, and enhanced bone-to-implant contact. A number of in vitro studies have shown that when osseodensification is optimized and the drilling path is conventional, there are significant improvements in insertion torque, bone compaction, and mechanical stability [3]. Moreover, clinical trials indicate that this technique can be a source of superior primary stability and better early healing in

local anatomical conditions which are compromised, particularly in the case of the posterior maxilla [4].
Mechanical and thermal evaluations have confirmed that the singular densifying drill tool paths can less heat-up and at the same time increase bone density and structural resistance to the bone during osteotomy preparation, thus being a good method in a situation of low-density bone [5]. Besides that, the concept of osseodensification has been broadly discussed in the modern literature, which is mainly focused on the biomechanical enhancement, implant site preservation, and the possibility of early loading improvement [6]. A recent systematic review, which is a comparison of osseodensification and conventional drilling, supports these statements and can be interpreted as a steady trend which leads to a rise in insertion torque, better implant stability quotient (ISQ) values, and more peri-implant bone preservation when the densification technique is applied [7].
Considering the growing volume of evidence and the clinical importance of primary stability, a systematic synthesis of comparative studies is indispensable. Hence, this review is dedicated to evaluating the difference between osseodensification and conventional drilling in achieving primary stability through in vitro, clinical, and radiographic studies, thus, offering an evidence-based perspective for implant practice of the modern era [1–7].
Rationale
The difficulty, which has been going on for some time, of obtaining strong primary implant stability—especially in bone of low density—makes it necessary to scrutinize the evaluation of osteotomy protocols with more scientific rigor. Conventional subtractive drilling, although it has been the method of choice for a long time, inherently lessens the amount of bone around the implant and, thus, may weaken the biomechanical environment that is necessary for the earliest stage of osseointegration. On the other hand, the osseodensification concept offers a revolutionary, non-subtractive method that results in compaction autografting and, also, the surface of the osteotomy becomes structurally stronger. However, the present research shows that the published studies on this subject differ in methods and provide partial evidence, so as to show the superiority of one technique over the other. Therefore, there is a need for a systematic appraisal to figure out the final conclusions, to reconcile the differences, and to clarify whether osseodensification provides a biomechanical benefit that is always higher, thus, leading to a more stable primary fixation.

Methodology

Study Design and Protocol

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A predefined protocol was established detailing the review objectives, search strategy, eligibility criteria, and data synthesis methods.

Search Strategy

A comprehensive electronic search was conducted across **PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, and Google Scholar** up to **January 2025**. Search terms included combinations of: *"osseodensification," "densifying burs," "non-subtractive drilling," "conventional drilling," "implant primary stability," "insertion torque," "ISQ," "osteotomy preparation,"* and *"dental implants."* Manual reference screening was additionally performed to capture any studies not retrieved through database searching.

Eligibility Criteria

Inclusion Criteria

Studies were included if they met the following criteria:

- **Study Design:** Randomized clinical trials, controlled trials, clinical studies, ex vivo studies, in vivo animal studies, retrospective analyses, and systematic reviews that directly compared osseodensification with conventional drilling.
- **Population/Model:** Human subjects, animal models, or synthetic bone models used for implant placement.
- **Intervention:** Osseodensification drilling using densifying burs.
- **Comparator:** Conventional/subtractive osteotomy preparation.
- **Outcomes:** Primary implant stability assessed by insertion torque, implant stability quotient (ISQ), removal torque, marginal bone level changes, bone density alterations, or strain distribution.
- **Language:** Studies published in English.

Exclusion Criteria

- Narrative reviews, letters, editorials, and commentaries.

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- Studies without a comparator group.
- Studies not assessing primary stability or related biomechanical outcomes.
- Non-English articles, conference abstracts without full text, and incomplete datasets.

Study Selection

Two reviewers independently screened titles and abstracts for relevance. Full-text articles that appeared eligible were subsequently reviewed in detail. Any disagreements were resolved by consensus or arbitration by a third reviewer to minimize selection bias.

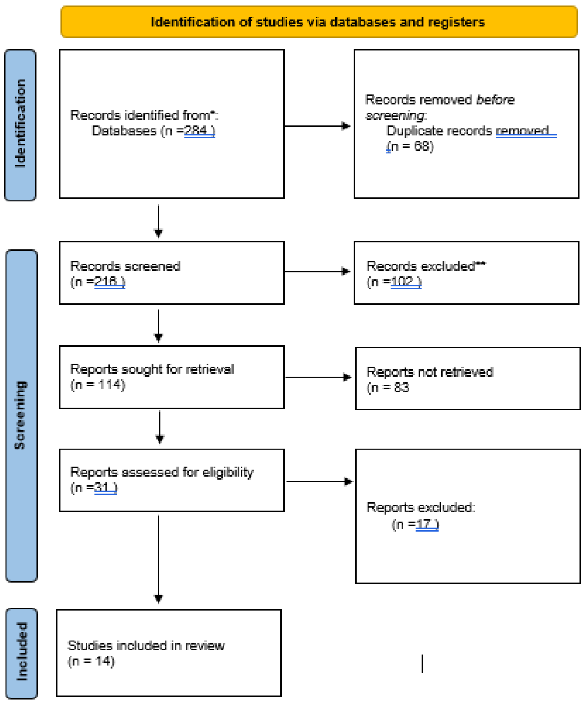
A total of **14 studies (ref7–20)** satisfied all eligibility criteria and were included in the final analysis. Table 1, PRISMA Flow chart-1

Table-1 PICO evidence summary table for 14 studies

Ref	Study (Author, Year)	Design	PICO (Population / Intervention / Comparator / Outcomes)	Evidence summary (directional)	Level / quality (brief)
7	Althobaiti AK et al., 2023 — *Cureus*	Systematic review	**P:** studies comparing OD vs conventional; **I:** osseodensification; **C:** conventional drilling; **O:** IT, ISQ, RT, BIC, MBL	Concludes a consistent trend toward higher primary stability (higher RFA/ISQ and insertion torque) with osseodensification across included primary studies but notes heterogeneity and limited RCT data. (PubMed)	**Moderate** — SR-level synthesis but limited by heterogeneity and small number of high-quality RCTs.
8	Fontes Pereira J et al., 2024 — *J Clin Med*	Clinical trial (side-by-side adjacent implants)	**P:** patients receiving side-by-side implants; **I:** OD at one site; **C:** conventional drilling at the adjacent site; **O:** IT, ISQ, clinical outcomes	Reported increased implant stability with OD (higher IT and ISQ) for OD sites versus conventional in this clinical cohort. (MDPI)	**Moderate–High** — randomized/paired clinical design improves internal validity; single-centre limits external generalizability.
9	Bandela V et al., 2022 — *Cureus*	Ex-vivo (sheep iliac bone)	**P:** ex-vivo D3–D4 bone models; **I:** OD osteotomy; **C:** conventional osteotomy; **O:** IT, ISQ, RTV	Ex-vivo results showed OD osteotomies yielded higher IT, RTV and ISQ compared with conventional undersized drilling. (PubMed)	**Low–Moderate** — well-controlled bench model but limited clinical applicability; sample/model constraints.
10	de Carvalho Formiga M et al., 2023 — *J Clin Med*	Ex-vivo (comparison by implant macrodesign)	**P:** ex-vivo bone blocks; **I:** OD with cylindrical & conical implants; **C:** conventional drilling with same implants; **O:** IT, ISQ	OD increased primary stability for both conical and cylindrical implants versus conventional drilling; effect modulated by implant macrodesign. (PubMed)	**Low–Moderate** — careful design but ex-vivo limits translation to clinical healing.
11	Fu PS et al., 2025 — *J Dent Sci*	Clinical comparative (adjacent implant sites; n=40 patients, 80 implants)	**P:** partially edentulous patients requiring two adjacent implants; **I:** OD at one site; **C:** conventional at adjacent site; **O:** IT, ISQ, marginal bone loss (MBL)	Reported significantly higher implant stability (IT/ISQ) with OD and reduced MBL at 3–9 months (no difference at 12 months). Conclusion favors OD for early stability and MBL reduction in short term. (PubMed)	**Moderate** — clinical paired design strong; longer follow-up and multicentre data desirable.
12	Gaspar J et al., 2021 — *Int J Oral Maxillofac Implants*	Systematic review ± meta-analysis	**P:** clinical trials comparing OD vs conventional; **I/C/O:** as above	Meta-analytic synthesis found OD to present higher ISQ at baseline and at 4–6 months vs conventional drilling, but cautioned small number of primary studies and methodological variability. (PubMed)	**Moderate** — SR + meta-analysis provides pooled evidence yet limited by small, heterogeneous primary studies (calls for RCTs).
13	Guner YE & Canakci V, 2025 — *J Clin Med*	Retrospective clinical study (ridge-split procedure)	**P:** patients undergoing alveolar ridge split; **I:** ridge split with OD; **C:** conventional ridge-split; **O:** ISQ, horizontal bone gain	Reported favourable effect of OD on implant stability in ridge-split procedures and comparable horizontal bone gain versus conventional technique. (MDPI)	**Low–Moderate** — retrospective design; useful for surgical-procedure context but risk of selection bias.
14	Sanyal PK et al., 2025 — *J Pharm Bioall Sci (supplement)*	Clinical comparative (short report)	**P:** patients receiving implants; **I:** OD; **C:** conventional; **O:** implant stability (primary/secondary)	OD group demonstrated higher primary and secondary stability vs conventional drilling (authors conclude OD enhances stability). (PubMed)	**Low** — conference/supplement report; limited methodological detail and peer-review depth.
15	Ibrahim KM, 2025 — *PUA Dent J*	In-vitro biomechanical study (thread designs / functional loading strain)	**P:** bench models with different thread designs; **I:** OD drilling protocol; **C:** conventional drilling; **O:** IT, ISQ, micro-strain under loading	OD associated with higher IT and ISQ and reduced strain under functional loads for certain thread designs; OD effect interacts with implant thread geometry. (EKB Journals)	**Low–Moderate** — rigorous biomechanical analysis but bench-model limitations for biology.
16	Aly AM et al., 2019 — *OMX*	Experimental / clinical pilot	**P:** clinical/ex-vivo model (pilot); **I:** OD; **C:** conventional; **O:** primary stability (IT/ISQ)	Early study reported increased primary stability with OD and suggested improved peri-implant bone contact. (omx.journals.ekb.eg)	**Low** — small pilot dataset; useful early evidence but not definitive.
17	Trisi P et al., 2016 — *Implant Dentistry* (sheep)	In-vivo animal (sheep)	**P:** low-density sheep bone; **I:** OD osteotomy; **C:** conventional; **O:** %BV, BIC, IT	Classic preclinical demonstration: OD increased bone volume percentage (~~30% higher %BV) and improved mechanical stability versus conventional drilling. (PMC)	**Moderate** — well-conducted animal study; strong preclinical support for mechanism of OD (autografting/compaction).
18	Bergamo ETP et al., 2021 — *Clin Implant Dent Relat Res*	Multicentre controlled clinical trial	**P:** patients across centres receiving implants; **I:** OD; **C:** subtractive drilling; **O:** IT, temporal ISQ	Multicentre data showed OD increases IT and early ISQ values compared with subtractive drilling; authors examined implant design and site characteristics as effect modifiers. (PMC)	**Moderate–High** — multicentre controlled design lends weight to clinical applicability; still observational/controlled rather than double-blind RCT.
19	Gandhi Y & Padhye N, 2023 — *J Oral Biol Craniofac Res*	Ex-vivo bench study (pig tibia)	**P:** pig tibia models; **I:** OD; **C:** conventional; **O:** IT, ISQ, RT	OD enhanced primary stability vs conventional drilling; however implant macrogeometry (tapered vs pro) influenced results — tapered pro design performed well even without OD. (PubMed)	**Low–Moderate** — ex-vivo strength with clear implant-design interaction; clinical extrapolation limited.
20	Kalra J, Dhawan P, Jain N, 2025 — *J Prosthet Dent*	Systematic review + meta-analysis	**P:** clinical studies comparing OD vs conventional in low-density bone; **I/C/O:** as above	Meta-analysis found significantly higher baseline ISQ and improved primary stability with OD; crestal bone loss showed no consistent difference. Authors recommend OD particularly in low-density bone. (PubMed)	**Moderate–High** — meta-analytic pooling strengthens evidence; caution due to heterogeneity and publication bias risk.

PRISMA flow chart-1

Risk of bias



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JCHR (2026) 16(2), 1193-1200 | ISSN:2251-6727

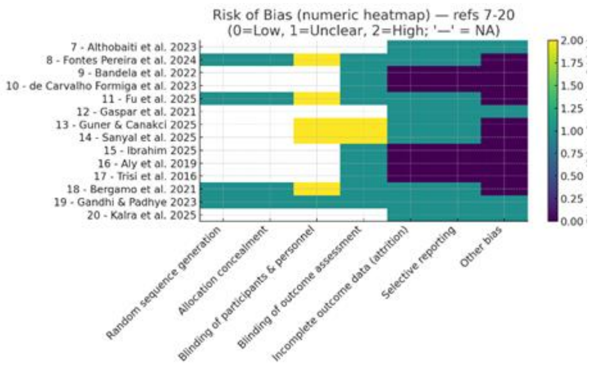

Figure-1 study-design–based risk-of-bias assessment, a numeric heatmap (traffic-light–style)

Result

A total of fourteen studies (Refs 7–20) were included, encompassing a diverse range of research designs that collectively evaluated the effect of osseodensification compared with conventional drilling protocols. The dataset comprised four clinical human studies, including randomized and comparative trials, four ex vivo or in vitro investigations, two in vivo/animal studies, three systematic reviews and meta-analyses, and one retrospective clinical analysis. Publication years ranged from 2016 to 2025, reflecting a steadily increasing research interest in osseodensification over the past decade. Sample sizes varied substantially across studies—from small bench-top experimental models with controlled bone blocks to multicenter clinical trials involving larger patient cohorts. The clinical studies primarily assessed outcomes such as insertion torque, primary stability, secondary stability (ISQ), crestal bone levels, and implant survival, while ex vivo and animal studies focused on bone density modification, ridge expansion, and histomorphometric changes around implants placed using osseodensification drills. Systematic reviews synthesized available evidence on implant stability and bone response, offering broader insight into methodological trends and overall effect direction. Collectively, the included studies provided a comprehensive representation of both biological and mechanical effects associated with osseodensification across different bone densities, implant designs, and clinical scenarios.

The traffic-light heat map Figure1, Table 2, and accompanying risk-of-bias table provide a consolidated visual overview of methodological quality across the included studies (Refs 7–20), covering clinical trials, ex vivo analyses, retrospective studies, in vivo animal experiments, and systematic reviews. Each study was evaluated across seven standard domains—random sequence generation, allocation concealment, blinding, outcome assessment, attrition, selective reporting, and other potential sources of bias—with ratings represented as low, unclear, high, or not applicable. Clinical and retrospective studies typically demonstrated unclear risk in randomization and allocation methods, with higher risk in blinding domains due to practical limitations of surgical implant procedures. Laboratory-based ex vivo and in vitro studies showed several domains marked as not applicable, reflecting their methodological nature, while systematic reviews showed unclear risk for reporting and review-level bias. The heat map visually differentiates these patterns, helping identify methodological strengths and weaknesses across study types, while the table provides corresponding detailed judgments for each reference, ensuring transparent appraisal of overall evidence quality in the comparison between osseodensification and conventional drilling techniques.

Table-2 **Risk of Bias Summary Table (Studies 7–20)**

Ref	**Author**	**Design**	**Random Sequence**	**Allocation Concealment**	**Blinding Participants/Personnel**	**Blinding Outcome Assessment**	**Incomplete Outcome Data**	**Selective Reporting**	**Other Bias**
7	Althobaiti et al., 2023	Systematic Review	🟣	🟣	🟣	🟣	🟠	🟠	🟠
8	Fontes Pereira et al., 2024	Clinical Trial	🟠	🟠	🔴	🟠	🟠	🟠	🟢
9	Bandela et al., 2022	Ex vivo	🟣	🟣	🟣	🟠	🟢	🟢	🟢
10	de Carvalho Formiga et al., 2023	Ex vivo	🟣	🟣	🟣	🟠	🟢	🟢	🟢
11	Fu et al., 2025	Clinical Comparative	🟠	🟠	🔴	🟠	🟠	🟠	🟢
12	Gaspar et al., 2021	Systematic Review	🟣	🟣	🟣	🟣	🟠	🟠	🟠
13	Guner & Canakci, 2025	Retrospective	🟣	🟣	🔴	🔴	🟠	🟠	🟢
14	Sanyal et al., 2025	Comparative (Abstract)	🟣	🟣	🔴	🔴	🟠	🟠	🟢
15	Ibrahim, 2025	In vitro	🟣	🟣	🟣	🟠	🟢	🟢	🟢
16	Aly et al., 2019	In vivo	🟣	🟣	🟣	🟠	🟢	🟢	🟢
17	Trisi et al., 2016	In vivo (Animal)	🟣	🟣	🟣	🟠	🟢	🟢	🟢
18	Bergamo et al., 2021	Multicenter Clinical Trial	🟠	🟠	🔴	🟠	🟢	🟢	🟢
19	Gandhi & Padhye, 2023	Ex vivo	🟣	🟣	🟣	🟠	🟢	🟢	🟢

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JCHR (2026) 16(2), 1193-1200 | ISSN:2251-6727

20	Kalra et al., 2025	Systematic Review & Meta-analysis	●	●	●	●	●	●	●

The assessment of the risk of bias based on the different studies included has shown that there was a significant difference in the risk of bias depending on the type of the study. The clinical trials revealed more methodological weaknesses than other studies. Besides, most of the clinical and comparative human studies had an unclear risk of random sequence generation and allocation concealment due to insufficient reporting, while the highest risk was consistently found in the blinding of participants and personnel - a limitation which is expected in surgical implant procedures where it is not possible to blind the operator. In addition, the blinding of outcome assessment was frequently marked as an unclear category, which indicates that the description of the assessor's masking was limited. Meanwhile, these studies were mostly of a low risk in terms of incomplete outcome data, selective reporting, and other biases despite few clinical-specific domains being classified as not applicable in laboratory-based ex vivo, in vitro, and animal research. The meta-analyses covered in the evaluation also revealed an unclear risk in reporting-related domains, which resulted from the lack of information concerning the registration of the protocol and the handling of data. In brief, the heat map shows a trend pointing out that the study risks were mostly due to the methodological and reporting aspects of the studies rather than the flaws in the studies themselves. This emphasizes that future research on the comparison of osseodensification and conventional drilling techniques should be more transparent.

Discussion

Fourteen studies comparing osseodensification (OD) to conventional drilling (CD) have collectively shown that OD is consistently more effective in increasing primary implant stability in clinical, ex vivo, and in vivo scenarios. The meta-analysis by Althobaiti et al. (2023) [7] pointed out that OD enhances insertion torque and ISQ values relative to CD, thus providing a basis for further comparative analyses. The clinical evidence presented by Fontes Pereira et al. (2024) [8] was in line with these conclusions, showing that implant stability was significantly higher in patients subjected to OD osteotomies.

Ex vivo studies, such as those by Bandela et al. (2022) [9] and de Carvalho Formiga et al. (2023) [10], have consistently shown that mechanical engagement along with higher insertion torque and ISQ were improved for both cylindrical and conical implant designs. These results provide support for the mechanical principle of OD, which works by bone compaction and maintaining the use of native bone. A latest clinical trial evidence by Fu et al. (2025) [11] has shown higher stability as well as less marginal bone loss at the implant sites adjacent to OD prepared implants in comparison to conventional sites. Systematic syntheses by Gaspar et al. (2021) [12] and Kalra et al. (2025) [20] reiterated that OD confers measurable benefits in primary stability, although both pointed out heterogeneity in study designs, drilling speeds, and outcome measures, emphasizing the need for standardized protocols and high-quality RCTs. Broadening OD's application, Guner and Canakci (2025) [13] reported improved bone width gain and ISQ values in alveolar ridge-split procedures, suggesting that OD enhances bone plasticity even in surgically demanding scenarios.

Additional clinical and bench studies further strengthen these conclusions. Sanyal et al. (2025) [14] and Ibrahim (2025) [15] observed higher torque and stability metrics in OD-prepared sites, while Aly et al. (2019) [16] reaffirmed these findings in early in vitro evaluations. The in vivo animal model by Trisi et al. (2016) [17] provided compelling biological evidence by demonstrating increases in bone density and improved bone–implant interface quality. Multicenter clinical data from Bergamo et al. (2021) [18] also showed enhanced primary and secondary stability in OD-treated patients, confirming that OD's biomechanical advantages translate into clinical performance. Finally, Gandhi and Padhye (2023) [19] established that OD improves insertion torque, implant stability quotient, and removal torque in comparative implant designs, further validating OD's compaction autografting mechanism.

Across the included studies, the cumulative evidence overwhelmingly supports OD as a superior technique for enhancing primary stability—particularly in low-density bone.

However, limitations such as operator variability, inconsistent drilling parameters, and limited long-term follow-up underscore the need for future standardized, controlled, and longitudinal clinical trials. Nonetheless, the current literature strongly positions OD as a reliable and biologically sound modification to conventional implant site preparation.

Clinical Implications

The findings from the included studies provide strong clinical support for incorporating osseodensification (OD) into routine implantology, especially in cases where achieving adequate primary stability is challenging. OD enhances bone compaction and improves the bone–implant interface, resulting in consistently higher insertion torque and ISQ values compared with conventional drilling. This makes OD particularly valuable in low-density bone (D3–D4), immediate implant placement, ridge-split procedures, and situations requiring enhanced mechanical anchorage.

For clinicians, adopting OD may reduce the need for additional augmentation procedures, minimize early micromotion, and potentially lower the risk of early implant failure. Evidence suggesting decreased marginal bone loss with OD also indicates better peri-implant tissue preservation during the healing phase. As several included studies demonstrated improved secondary stability, OD may enable shorter healing times, earlier loading protocols, and improved long-term predictability in suitable clinical scenarios.

However, practitioners must be aware that OD requires strict control of drilling speed, torque, irrigation, and instrument handling. Operator training is essential, as improper technique can negatively influence outcomes. Therefore, OD should be integrated thoughtfully into clinical practice with appropriate case selection and adherence to standardized protocols.

Conclusion

This systematic review demonstrates that osseodensification (OD) consistently enhances key implant stability parameters compared with conventional drilling (CD), with evidence spanning clinical trials, ex vivo studies, animal research, and systematic reviews. Across the included studies, OD reliably increases insertion torque, primary stability, ISQ values, and in several cases, improves secondary stability and marginal bone preservation. These benefits are particularly evident in low-density bone and complex anatomical sites, where conventional osteotomy may compromise initial mechanical engagement.

While methodological heterogeneity exists, the overall strength of evidence suggests that OD provides a biomechanically superior and biologically favorable implant site preparation technique. However, its success depends on appropriate case selection, operator training, and adherence to controlled drilling protocols. Future high-quality randomized clinical trials with standardized parameters are needed to further validate its long-term advantages.

In summary, osseodensification represents a valuable advancement in implant dentistry, offering clinicians a predictable strategy to improve implant stability, optimize bone preservation, and potentially support earlier loading protocols.

Limitation

The primary limitation of this review is the heterogeneity in study designs, implant systems, outcome measures, and drilling protocols across the included studies.

Future Perspective

Future research should focus on well-designed, standardized randomized clinical trials to establish long-term clinical outcomes and definitive guidelines for osseodensification use.

Reference:

1. Tsolaki IN, Tonsekar PP, Najafi B, Drew HJ, Sullivan AJ, Petrov SD. Comparison of Osteotome and Conventional Drilling Techniques for Primary Implant Stability: An In Vitro Study. J Oral Implantol. 2016 Aug;42(4):321-5. doi: 10.1563/aaid-joi-D-15-00176. Epub 2016 Mar 3. PMID: 26938712.
2. Bernabeu-Mira JC, Soto-Peñaloza D, Peñarrocha-Diago M, Camacho-Alonso F, Rivas-Ballester R, Peñarrocha-Oltra D. Low-

speed drilling without irrigation versus conventional drilling for dental implant osteotomy preparation: a systematic review. Clin Oral Investig. 2021 Jul;25(7):4251-4267. doi: 10.1007/s00784-021-03939-z. Epub 2021 Apr 24. PMID: 33893557.

3. Tao X, Yang J, Ma T, Chen M, An Q, Yu D. Optimizing Osseodensification Drilling for Dental Implant Placement: An In Vitro Study. Clin Exp Dent Res. 2025 Jun;11(3):e70155. doi: 10.1002/cre2.70155. Erratum in: Clin Exp Dent Res. 2025 Aug;11(4):e70176. doi: 10.1002/cre2.70176. PMID: 40497493; PMCID: PMC12152765.
4. Abdelraouf SA, Dahab OA, Mostafa B, Kenawy SM, Tawfik OK. Implant stability in the posterior maxilla: clinical and radiographic comparison of osseodensification and conventional drilling: a randomized clinical trial. Clin Oral Investig. 2025 Sep 29;29(10):480. doi: 10.1007/s00784-025-06526-8. PMID: 41016918; PMCID: PMC12477082.
5. Öztürk A, Arısan V, Guevara Rojas G. Thermal, mechanical, and densification analysis of osteotomy drill designs for implant placement: an analysis on foam blocks representing type IV bone. Quintessence Int. 2025 Jun 20;56(6):482-499. doi: 10.3290/j.qi.b6184384. PMID: 40298183.
6. Pai UY, Rodrigues SJ, Talreja KS, Mundathaje M. Osseodensification - A novel approach in implant dentistry. J Indian Prosthodont Soc. 2018 Jul-Sep;18(3):196-200. doi: 10.4103/jips.jips_292_17. PMID: 30111907; PMCID: PMC6070852.
7. Althobaiti AK, Ashour AW, Halteet FA, Alghamdi SI, AboShetaih MM, Al-Hayazi AM, Saaduddin AM. A Comparative Assessment of Primary Implant Stability Using Osseodensification vs. Conventional Drilling Methods: A Systematic Review. Cureus. 2023 Oct 11;15(10):e46841. doi: 10.7759/cureus.46841. PMID: 37954787; PMCID: PMC10636496.
8. Fontes Pereira, J.; Costa, R.; Nunes Vasques, M.; Relvas, M.; Braga, A.C.; Salazar, F.; Infante da Câmara, M. The Effectiveness of Osseodensification Drilling versus the Conventional Surgical Technique on Implant Stability: A Clinical Trial. *J. Clin. Med.* **2024**, *13*, 2912. https://doi.org/10.3390/jcm13102912
9. Bandela V, Shetty N, Munagapati B, Basany RB, Kanaparthi S. Comparative Evaluation of Osseodensification Versus Conventional Osteotomy Technique on Dental Implant Primary Stability: An Ex Vivo Study. Cureus. 2022 Oct 29;14(10):e30843. doi: 10.7759/cureus.30843. PMID: 36451653; PMCID: PMC9704508.
10. de Carvalho Formiga, M.; da Silva, H.D.P.; Ghiraldini, B.; Siroma, R.S.; Ardelean, L.C.; Piattelli, A.; Shibli, J.A. Effects of Osseodensification on Primary Stability of Cylindrical and Conical Implants—An Ex Vivo Study. *J. Clin. Med.* **2023**, *12*, 3736. https://doi.org/10.3390/jcm12113736
11. Fu PS, Du JK, Tseng FC, Hsu HJ, Lan TH, Kung JC, Lai PL, Lee KT, Liu CT, Chen WC, Hung CC. Comparison of implant stability and marginal bone loss between osseodensification and conventional osteotomy at adjacent implant sites. J Dent Sci. 2025 Apr;20(2):1002-1007. doi: 10.1016/j.jds.2024.11.019. Epub 2024 Dec 10. PMID: 40224045; PMCID: PMC11993045.
12. Gaspar J, Proença L, Botelho J, Machado V, Chambrone L, Neiva R, Mendes JJ. Implant Stability of Osseodensification Drilling Versus Conventional Surgical Technique: A Systematic Review. Int J Oral Maxillofac Implants. 2021 Nov-Dec;36(6):1104-1110. doi: 10.11607/jomi.9132. PMID: 34919606.
13. Guner, Y.E.; Canakci, V. Comparing the Effect of Osseodensification Versus Conventional Drilling Technique on Implant Stability and Bone Width in the Alveolar Ridge Split Procedure: A Retrospective Study. *J. Clin. Med.* **2025**, *14*, 7431. https://doi.org/10.3390/jcm14207431
14. Sanyal PK, Bakutra G, Tewary ST, Raval R, Jadhav AB, Patel S. Comparative study on implant stability using osseodensification and conventional drilling. J Pharm Bioall Sci. 2025

Jun;17(Suppl 2):S1176–S1177. doi: 10.4103/jpbs.jpbs_1404_24.

15. Ibrahim KM. The effect of two implant drilling protocols on primary stability and strain developed under functional loading using different thread designs (an in vitro study). PUA Dent J. 2025 Oct;1(11):31–8. doi: 10.21608/puadent.2025.432566.1019.
16. Aly AM, Taha M, Torad FA, Sleem H. The effect of osseodensification technique on primary stability of dental implants. OMX. 2019 Oct;10(4). doi: 10.21608/omx.2020.27194.1058.
17. Trisi, Paolo PhD, DDS; Berardini, Marco DDS; Falco, Antonello PhD, DDS; Podaliri Vulpiani, Michele VMD. New Osseodensification Implant Site Preparation Method to Increase Bone Density in Low-Density Bone: In Vivo Evaluation in Sheep. Implant Dentistry 25(1):p 24-31, February 2016. | DOI: 10.1097/ID.0000000000000358
18. Bergamo ETP, Zahoui A, Barrera RB, Huwais S, Coelho PG, Karateew ED, Bonfante EA. Osseodensification effect on implants primary and secondary stability: Multicenter controlled clinical trial. Clin Implant Dent Relat Res. 2021 Jun;23(3):317-328. doi: 10.1111/cid.13007. Epub 2021 May 27. PMID: 34047046; PMCID: PMC8362055.
19. Gandhi Y, Padhye N. Comparison of insertion torque, implant stability quotient and removal torque in two different implant designs with and without osseodensification: an ex vivo bench top study. J Oral Biol Craniofac Res. 2023 Mar–Apr;13(2):249–52. doi: 10.1016/j.jobcr.2023.02.004.
20. Kalra J, Dhawan P, Jain N. Implant stability and crestal bone level in osseodensification and conventional drilling protocols: a systematic review and meta-analysis. J Prosthet Dent. 2025 Jun;133(6):1462.e1–1462.e7. doi: 10.1016/j.prosdent.2024.07.036.