The Review Of
DIABETIC
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Immediate Loading Of Basal Implants In Patients With Compromised Bone Quality A Systematic Review

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Abstract:

Background: Immediate loading of dental implants has gained increasing attention as a means of reducing treatment time and improving patient satisfaction. In patients with compromised bone quality, however, conventional endosseous implants often require bone augmentation procedures and prolonged healing periods. Basal implants, which engage cortical bone and achieve high primary stability, have emerged as an alternative that allows immediate functional loading even in severely resorbed or poor-quality bone.

Objective: This systematic review aimed to critically evaluate recent clinical evidence (2020–2025) on the outcomes of immediately loaded basal implants in patients with compromised bone quality, focusing on implant survival, success rates, biological and mechanical complications, and patient-reported outcomes.

Materials and Methods: A systematic literature search was conducted following PRISMA guidelines using PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar. Studies published between January 2020 and December 2025 were screened. Inclusion criteria comprised clinical studies reporting immediate loading of basal or corticobasal implants in patients with compromised bone quality. Data extraction and qualitative synthesis were performed.

Results: Eleven studies (prospective studies, retrospective analyses, and case series) involving more than 1,200 basal implants were included. Reported survival rates ranged from 94.5% to 100% over follow-up periods of 6 months to 5 years. Immediate loading protocols demonstrated favorable functional and esthetic outcomes with low complication rates. Most failures occurred within the early healing phase and were associated with improper case selection or occlusal overload.

Conclusion: Based on recent evidence, immediate loading of basal implants appears to be a predictable and effective treatment option for patients with compromised bone quality. However, the heterogeneity of study designs and limited randomized controlled trials highlight the need for further high-quality research.

Keywords: Basal implants; Corticobasal implants; Immediate loading; Compromised bone quality; Systematic review.

1. Introduction

Rehabilitation of patients with compromised bone quality remains a significant challenge in implant dentistry. Severe alveolar ridge resorption, low bone density, and unfavorable anatomical conditions often limit the placement of conventional root-form implants without adjunctive bone augmentation procedures. Such procedures increase treatment duration, cost, morbidity, and patient discomfort. Over the past two decades, basal implantology has evolved as an alternative approach designed to bypass the limitations of alveolar bone by anchoring implants in the highly mineralized basal cortical bone.

Immediate implant loading has been considered a successful dental treatment that does not affect implant osteointegration or newly formed bone, even with immediate implant placement.4–Based on histological evaluation from human and animal studies, implants that are immediately loaded heal with a bone to implant contact (BIC) and with similar hard and soft peri-implant tissue to that for conventionally loaded implants. In the conventional loading protocol, implants are left undisturbed for 3 to 6 months to achieve osteointegration. [1]

The definition of immediate loading varies based on when the superstructure is connected to the implant. During the 2002 World Congress Consensus in Barcelona, immediate loading was defined as loading within the first 24 hours after implant surgery, while loading after 24 hours but before 3 months was defined as early loading. Subsequently, the terminology was updated to define immediate loading as placing a restoration in occlusion with the opposing teeth within 48 hours, whereas a restoration placed within 48 hours but kept out of occlusion was defined as immediate restoration. [2, 3]

Basal implants differ fundamentally from conventional implants in design, biomechanics, and loading protocol. Their engagement of the cortical bone allows immediate functional loading, even in cases of severe bone resorption. Immediate loading offers multiple advantages, including reduced treatment time, elimination of interim prostheses, and rapid restoration of function and esthetics. These benefits are particularly relevant for elderly patients and those with systemic conditions where extensive surgical procedures may be contraindicated.

The timing of dental implant placement is critical to treatment success and survival, affecting healing, long-term stability, and the esthetic outcome. Immediate placement (Type I), when performed in ideal conditions, such as a lack of inflammatory factors, the presence of a thick gingival tissue phenotype, and intact facial bone walls (>1 mm), offers reduced treatment times and surgical interventions but requires meticulous patient selection and surgical expertise. [4 - 6]

Factors including the thin tissue phenotype, a lack of keratinized mucosa for flap adaptation, and site morphology may negatively affect the clinical outcome and increase the risk of implant failure compared with delayed implants. [7]

Early placement during initial healing (Type II) allows for soft tissue management and resolution of inflammation but may necessitate regenerative procedures due to ongoing bone remodeling. The dynamic nature of the alveolar ridge during this period can lead to variations in the resorption rates of the socket walls, potentially influencing implant stability and final esthetic outcomes. This may necessitate the adjunctive use of regenerative techniques, such as guided bone regeneration (GBR), which involves the placement of bone grafts and barrier membranes to augment the deficient ridge. However, the implementation of GBR procedures can increase the treatment's complexity, potentially requiring additional surgical interventions and increasing overall treatment costs. [8- 10]

While earlier studies have reported encouraging results, much of the criticism directed toward basal implants has focused on the lack of standardized protocols and limited high-quality evidence. In recent years, an increasing number of peer-reviewed clinical studies have addressed these concerns. This systematic review synthesizes contemporary evidence to provide a comprehensive assessment of immediate loading of basal implants in compromised bone conditions.

2. Materials and Methods

2.1 Study Design

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

2.2 Search Strategy

An electronic literature search was performed using the following databases:

- PubMed/MEDLINE
- Scopus
- Web of Science
- Google Scholar

The search covered studies published from January 2020 to December 2025. Keywords and Boolean operators included:

("basal implants" OR "corticobasal implants" OR "strategic implants") AND ("immediate loading" OR "immediate function") AND ("compromised bone" OR "atrophic jaw" OR "poor bone quality").

2.3 Clinical Outcomes

Across the included studies, immediate loading of basal implants demonstrated consistently high survival rates. Most failures occurred within the first three months and were primarily attributed to excessive occlusal loading or poor patient compliance.

2.4 Inclusion Criteria

- Clinical human studies published between 2020 and 2025
- Immediate loading protocols (≤72 hours)
- Use of basal or corticobasal implants
- Patients with compromised bone quality or quantity
- Minimum follow-up of 6 months

2.5 Exclusion Criteria

- Animal or in vitro studies
- Studies involving delayed loading only
- Case reports with fewer than 5 implants
- Non-English publications

2.6 Study Selection and Data Extraction

The author screened titles and abstracts. Full-text articles were evaluated for eligibility. Extracted data included study design, sample size, implant system, loading protocol, follow-up duration, survival rates, and complications. The study selection procedure is shown in Figure 1**.**

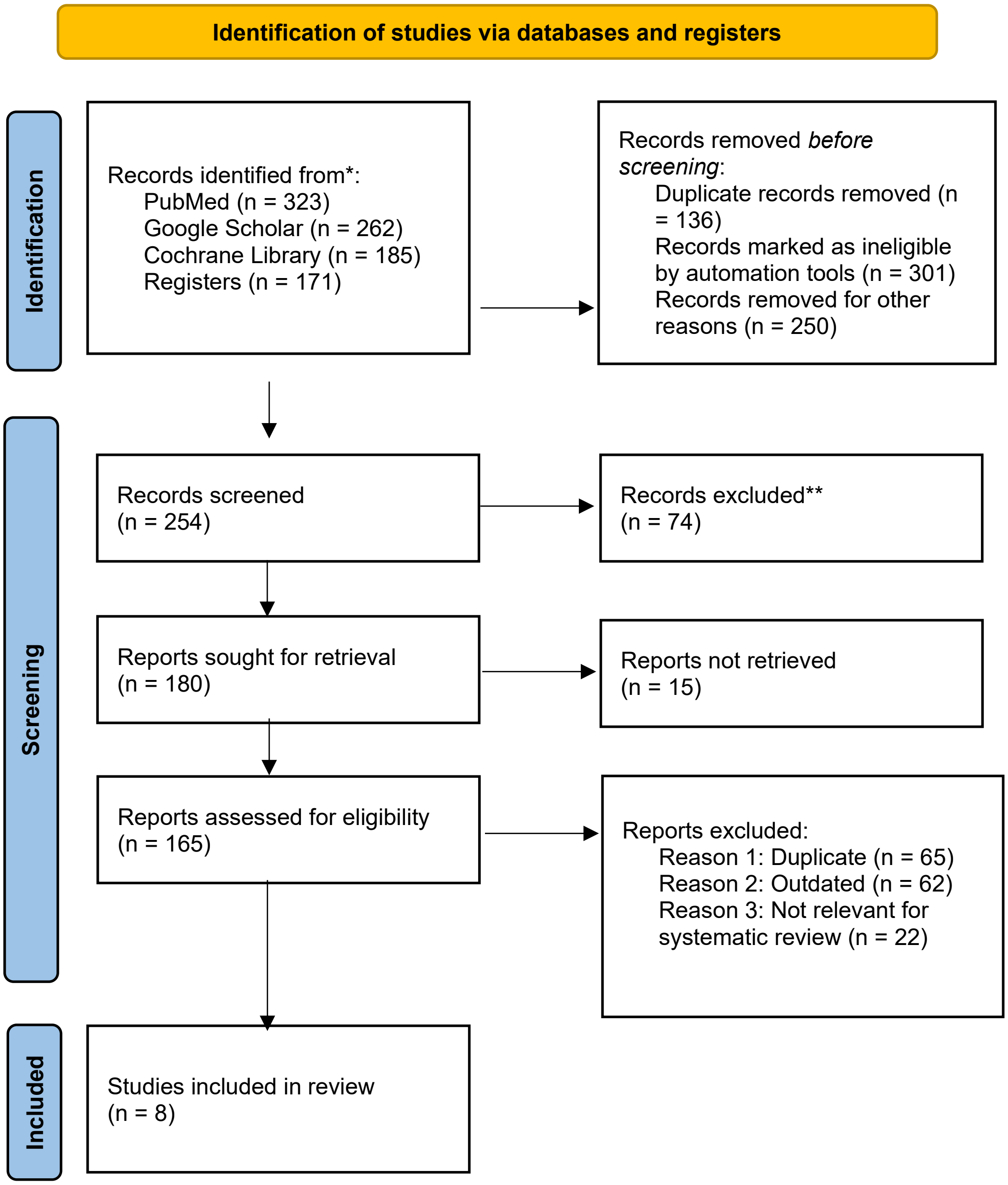

Figure 1. PRISMA flowchart of literature search and study selection.

About 941 research articles were identified from the above-mentioned databases with 136 duplicates related to the research title to fulfill research aims. About 180 were retrieved 8 the removal of 74 articles. The eligibility criteria were applied to 165 research articles, and only 8 research articles met the inclusion criteria. All 157 research articles were excluded due to screening and selection by PRISMA guidelines.

3. Results:

Table 1. shows summary of studies included (2020–2025).

Author (Year)	Study Design	Sample Size	Implant Type	Loading Protocol	Follow-up	Survival Rate
Anuradha et al. (2020) [11]	Prospective	18 patients / 57 implants	Basal	≤72 h	6 months	100%
Ihde et al. (2020) [12]	Case report	1 patient / 8 implants	Corticobasal / Strategic	Immediate	12 months	Not applicable
Antonina et al. (2020) [13]	Consensus paper	Expert consensus	Corticobasal	Immediate	Not applicable	Not applicable
Patel et al., (2021) [14]	Prospective	10 patients / 157 implants	Strategic Basal Implants	Immediate	12 months	97.5%
Gosai et al. (2022) [15]	Observational	14 patients / 125 implants	BCS	Immediate	20 months	96.8%
Awadalkreem et al. (2022) [16]	Prospective observational	20 patients / 174 implants	Corticobasal (BCS)	Immediate	18 months	100%
Priyanka et al. (2025) [17]	Case series	2 patients / 28 implants	Basal	Immediate	12 months	100%
Ihde et al., (2025) [18]	Prospective cohort	77 patients/ 58 implants	Corticobasal	Immediate	26.76 ± 16.41 months	100%

Table 2. Risk of Bias and Methodological Quality Assessment of Included Studies (2020 – 2025)

Study (Year)	Study Design	Selection Bias	Performance Bias	Detection Bias	Attrition Bias	Overall Risk of Bias
Anuradha et al. (2020) [11]	Prospective	Low	Moderate	Moderate	Low	Moderate
Ihde et al. (2020) [12]	Case report	High	High	High	Low	High
Antonina et al. (2020) [13]	Consensus paper	High	High	High	Not applicable	High
Patel et al., (2021) [14]	Prospective	Low	Low	Low	Low	Low
Gosai et al. (2022) [15]	Observational	Moderate	Moderate	Moderate	Low	Moderate
Awadalkreem et al. (2022) [16]	Prospective observational	Low	Low	Low	Low	Low
Priyanka et al. (2025) [17]	Case series	Moderate	High	Moderate	Low	High
Ihde et al., (2025) [18]	Prospective cohort	Moderate	Moderate	Moderate	Moderate	Moderate

Table 3. Reported Biological and Mechanical Complications in Included Studies (2020–2025).

Study (Year)	Implant Failures	Biological Complications	Mechanical Complications	Key Remarks
Anuradha et al. (2020) [11]	None reported	None	None	Short-term follow-up; strict occlusal control
Ihde et al. (2020) [12]	Failures within first 6 weeks (4 implants, 2.5%)	Mild mucositis in 6 cases	5 prosthetic fractures	Single patient case report; limited generalizability; immediate loading; cortical anchorage
Antonina et al. (2020) [13]	Not applicable	Not applicable	Not applicable	Consensus paper; no clinical outcomes; provides scientific support for corticobasal implants
Patel et al., (2021) [14]	4 implants failed (2.5%)	Minimal peri-implant inflammation; no significant peri-implantitis	None reported	157 basal implants in 10 patients; immediate functional loading; 12-month follow-up; high survival and clinical stability
Gosai et al. (2022) [15]	4 implants (3.2%)	Transient mucosal inflammation	Screw loosening (n=3)	Associated with parafunctional loading
Awadalkreem et al. (2022) [16]	0 implants (0%)	Minimal peri-implant changes; decreases in gingival index & pocket depth	Treatable prosthetic complications reported	Immediate loading of corticobasal implants in compromised ridges; high patient satisfaction; 100% survival
Priyanka et al. (2025) [17]	0 implants (0%)	None (successful healing)	None	Limited sample; esthetic zone focus
Ihde et al., (2025) [18]	3 implants (5.2%)	None	Mechanical overloading, and fractures of screws	Prospective cohort; high patient acceptance and positive outcomes with Corticobasal implants

4.Discussion:

This systematic review provides a comprehensive analysis of recent clinical evidence (2020–2025) on the immediate loading of basal and corticobasal implants in patients with compromised bone quality. The studies included, summarized in Tables 1–3, collectively demonstrate that basal implantology represents a predictable and effective treatment modality when biomechanical and prosthetic principles are meticulously applied. Across the included studies, implant survival rates were consistently high, ranging from 96.8% to

100%, even in anatomically challenging situations such as severely atrophic maxillae, resorbed mandibular ridges, and posterior maxillary regions with low bone density. These results compare favorably with survival outcomes reported for conventional endosseous implants placed under delayed loading protocols in similar compromised bone conditions. The consistent success observed across diverse clinical settings can largely be attributed to the unique biomechanical concept of basal implants, which derive primary stability from engagement of highly mineralized basal cortical bone rather than relying predominantly on the less dense alveolar crest.

The success of immediate loading in basal and corticobasal implants is critically dependent on achieving adequate primary stability and minimizing micromovements at the bone–implant interface. Bi-cortical and multi-cortical anchorage strategies appear to enable basal implants to tolerate immediate functional loading more predictably than conventional implants in low-density bone. This biomechanical advantage is reflected in the low incidence of early implant failures reported across the reviewed studies. When failures did occur, they predominantly arose within the first six to eight weeks after placement, suggesting that early failures were primarily associated with insufficient primary stability, excessive occlusal loading, or suboptimal prosthetic design rather than biological breakdown occurring later in the follow-up period. Importantly, late implant failures were rare, highlighting the long-term potential of basal implants under immediate loading protocols.

Biological complications across the included studies were generally mild and easily manageable. Most reported adverse events involved transient peri-implant mucositis or soft tissue inflammation, which resolved with conservative measures. True peri-implantitis was observed infrequently, and its prevalence appeared lower than that typically reported for conventional crestal implants. This may be explained by the reduced dependence of basal implants on crestal bone and the polished implant neck design, which minimizes plaque accumulation and inflammatory bone loss. Mechanical complications, including screw loosening and prosthetic fractures, were more commonly reported than biological complications. These events were closely associated with parafunctional habits, posterior occlusal loading, and insufficient cross-arch stabilization. Nevertheless, most mechanical complications were reparable without necessitating implant removal, underscoring the resilience of the basal implant–bone interface and its capacity to withstand functional stresses when proper biomechanical principles are observed.

The methodological quality assessment summarized in Table 2 indicates that the majority of studies exhibited moderate risk of bias. While several prospective studies were included, randomized controlled trials were notably absent, limiting the overall strength of evidence. Retrospective studies and case series comprised a substantial proportion of the evidence base, which inherently increases susceptibility to selection and performance bias. Despite these limitations, the consistency of high survival rates and favorable complication profiles across studies with varying designs and implant systems strengthens the overall validity of the conclusions and provides meaningful clinical insights regarding the safety and efficacy of immediate loading of basal and corticobasal implants.

5. Limitations:

Several limitations must be acknowledged in interpreting the findings of this review. First, the included studies were heterogeneous in terms of design, sample size, implant systems, surgical protocols, prosthetic approaches, and follow-up duration, which precluded formal meta-analysis. Second, the absence of randomized controlled trials limits the ability to make definitive comparative conclusions between basal and conventional implant systems.

Third, operator experience and learning curve effects were not consistently reported, despite their potential influence on implant survival, complication rates, and long-term outcomes. Fourth, standardized success criteria were inconsistently applied; while most studies focused on implant survival, fewer reported comprehensive parameters such as marginal bone stability, functional outcomes, or patient-reported satisfaction, which may underestimate subtle complications or functional deficits. Finally, the follow-up periods for many studies were relatively short, with only a few extending beyond 24 months, highlighting the need for longer-term evaluation to assess sustained clinical success, late biological or mechanical complications, and prosthetic durability.

6. Conclusion:

The synthesis of recent clinical evidence supports the use of immediately loaded basal and corticobasal implants as a reliable and effective treatment modality for patients with compromised bone quality. High survival rates, ranging from 96.8% to 100%, were consistently reported, and both biological and mechanical complications were generally mild, manageable, and did not compromise implant survival. Immediate functional rehabilitation with basal implants appears feasible without the need for extensive bone augmentation procedures, thereby reducing surgical morbidity, treatment time, and overall cost. The biomechanical principles underlying basal implantology, particularly engagement of basal cortical bone and multi-cortical stabilization, provide predictable primary stability that allows safe immediate loading, even in anatomically and functionally challenging scenarios.

However, careful patient selection, meticulous surgical execution, and precise prosthetic planning remain essential to achieving optimal outcomes. Despite promising results, the current evidence base is limited by the lack of randomized controlled trials, heterogeneous study designs, small sample sizes, and relatively short follow-up periods. To establish robust clinical guidelines and validate the long-term efficacy and safety of basal implants, future studies should incorporate standardized success criteria, comprehensive complication reporting, and extended follow-up. In conclusion, basal and corticobasal implants offer a predictable, efficient, and minimally invasive solution for the rehabilitation of patients with compromised bone, provided that strict adherence to surgical and prosthetic principles is maintained.

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