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1

REVIEW ARTICLE **OPEN ACCESS**

Literature Review Regarding the Applicability and Clinical Outcome of Basal Implant

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Abstract:

Objective: Restoring moderate to severely atrophic jaws with conventional implants often involves extensive surgical procedures. Basal implants, designed for immediate use in atrophied jawbones, offer an alternative by supporting single and multiple-unit restorations in the upper and lower jaws without the need for risky and expensive bone augmentation. However, their success rate diminishes significantly in areas with limited residual bone. This review aims to assess the applicability of basal implants compared to conventional endosseous implants.

Methods: A comprehensive literature review was conducted utilizing PubMed, Scopus, the Cochrane Library, EMBASE, and Google Scholar. The analysis focused on manuscripts and overviews published over a span of 20 years until September 8, 2022.

Results: Studies indicate that basal implants are a reliable option in specific cases, especially when other implants are not feasible, such as in severe alveolar bone atrophy. However, there is insufficient strong evidence to recommend basal implants over conventional ones. The evidence level of the reviewed papers all belong to evidence level V, which encompasses case reports and studies lacking controls.

Conclusions: The advantages of basal implants over conventional implants remain uncertain. The standard of care in dentistry should prioritize evidence-based practices, which commonly include the use of conventional implants. Further research is necessary to establish their efficacy and suitability in various clinical scenarios.

Keywords: Basal implant, Conventional implant, Implant applicability, Dental implants, Jaw bones, Orthopedic implants.

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1. INTRODUCTION

Dental implants have become highly popular for replacing missing teeth, with numerous implant systems and techniques documented in the literature. One such approach in dental implantology is basal implantology, which relies on the dense basal cortical jawbones to

anchor implants and bear the load. This concept draws inspiration from orthopedic implants used in knee or hip replacements, applying similar principles for stability and support [1, 2]. The concept of basal single-piece dental implants, where the fixture and abutment are integrated into one piece, was introduced in 1972 by Dr. Jean-Marc Julliet [3]. This concept was later extended with the development of Disk implants, Basal Osseo-Integrated implants, and Lateral Basal Implants [2, 4]. Dr. Stefan Idhe introduced advancements in dental implant technology, introducing bendable vertical implant shafts. Subsequently, screw-shaped immediate basal implants, referred to as Basal Cortical Screws, were developed as part of these ongoing innovations [5].

In the existing literature, diverse viewpoints on basal implants can be found. Certain researchers view this treatment approach as superior and more beneficial when compared to conventional (crestal) implants [1, 2, 5]. A conventional implant typically refers to a dental implant that follows traditional protocols and procedures for placement and restoration. This implant comes in two pieces - a component for the root and a component for the teeth. These two components are joined together using a small screw. However, contrasting these views, other researchers do not support these claims [6]. According to Garg *et al*., in 2017, basal implants were found to be associated with higher pain levels compared to immediately loaded and delayed-loaded conventional implants [6]. Additionally, it was noted that cantilever prostheses experienced reduced bone stress when supported by endosseous implants [7]. For bicortical basal implants, certain researchers reported a 15% incidence of biological complications and a 56% incidence of mechanical complications [8]. There were also reports of basal implant fractures, with endosteal implants being proposed as a straightforward solution in such cases [9].

Given the ongoing debate and the need to delve into the supporting evidence for basal dental implants, this review is undertaken. The primary objective of this review is to examine the available evidence regarding basal implants and assess the claims suggesting their superiority over conventional endosseous implants.

2. MATERIALS AND METHODS

2.1. Research Question and Search Strategy

Is there clinical superiority in use behind basal implants over conventional endosseous implants?

The literature search of PubMed, Scopus, Cochrane Library, EMBASE, Google Scholar, and Research Gate databases was performed until 8th of September 2022. A supplementary manual search of reference lists from the identified literature was performed to find further literature. Keyword search included “Basal Implants,” “Bicortical Implants,” “Strategic Implants,” “Basal Cortical Screw,” “Lateral Basal Implants,” “Basal Osseo-Integrated implants,” “Disk Implants,” “single piece implants,” OR “Bicortical anchorage.”

Case reports and original articles were all included in the search. Abstracts of the resulting articles were reviewed according to inclusion criteria. Full-text studies published in any language in scientific journals were included for further scrutiny, and an initial list of eligible papers was generated. The results of 17 studies were included in this review. Unpublished data and unrelated articles were excluded.

2.1.1. Inclusion Criteria

- Clinical studies in the scope of basal implants
- Full-text articles
- English language studies
- Studies published in the period between 2000 and 2022

2.1.2. Exclusive Criteria

- Preclinical studies
- Conference reports or abstracts,
- *In vitro* studies
- Review or systematic review papers.

2.2. Level of Evidence

The level of evidence was described by Sacket, based on the levels of evidence used in previous studies [10, 11].

3. RESULTS

3.1. Analysis of Literature Search

A total of 932 titles were retrieved from the initial search. These titles were filtered using dentistry-related keywords and subjected to inclusion as well as exclusion criteria, and discussions among the authors. Ultimately, 17 papers were selected for this review, each addressing various aspects of basal implants.

3.2. Applicability of Basal Implant

Among the retrieved papers, only six constitute clinical studies (Table **1**), while the remaining 11 are clinical case reports (Table **2**). Clinical studies suggest that basal implants enhance the rehabilitation of patients with compromised bone quality and/or quantity, as immediate rigid implant splinting helps distribute peak forces. However, these studies indicate the need for further research to solidify the clinical benefits of basal implants and emphasize the importance of controlling occlusion to reduce the risk of mechanical complications [8, 12-15]. Conversely, two studies highlight challenges associated with basal implants, such as difficulty in replacement, increased intraoperative pain and time, and the shifting of maximum stress regions during osseointegration from the early healing phase to full osseointegration [6, 16].

In terms of clinical case reports, although most are short-term and lack optimal tools for analyzing peri-implant bone, they primarily focus on patients' masticatory function and aesthetics with immediate loading of basal implants [1, 17-23]. Some reports suggest basal implants are a viable option in specific cases, such as patients with head and neck cancer with a history of radiation therapy. Some reports suggest basal implants are a viable option in specific cases, such as patients with head and neck cancer with a history of radiation therapy [19] and severe atrophic alveolar bone cases [24-26].

Table 1. The main aims and findings of clinical studies are included in this review.

Reference	Year	Type of Study	Aims	Findings
Anuradha *et al*. [12]	2020	Clinical study	Evaluate clinically, radiographically, and functionally the outcomes of basal implants in the compromised bone.	Basal implants improve the rehabilitation of patients where compromised quality and/or quantity of bone is present.
Fadia Awadalkreem *et al*. [13]	2020	Clinical study	Evaluate and compare patients' satisfaction when changing from fixed, removable, and/or conventional implant prostheses to basal implant-supported prostheses.	Basal implant-supported prostheses have a positive impact on oral health and highly increase patient satisfaction.
Łukasz R Pałka [14]	2019	Clinical study	This study aimed to assess many aspects of bicortical screw implants used to retain full-arch and segmental cemented prostheses in the rehabilitation of the mandible and maxilla in patients with or without a history of periodontal disease.	Bicortical smooth surface implant with immediate loading protocol provided predictable outcomes. More studies are needed to further support the clinical advantage of bicortical anchorage smooth surface implants.
Ritesh Garg *et al*. [6]	2017	Clinical study	Evaluate the survival of endo-osseous immediate loading implant and basal implants in atrophic jaws with an objective to compare implant survival in atrophic jaws for full mouth rehabilitation during 3-year follow-up.	It is difficult to replace a basal implant. Intraoperative pain and time are more frequent with basal implants. Mild bone loss and gingival recession.
Sigmar Kopp *et al*. [15]	2011	Clinical study	To study the amount and distribution of pressure, stress, and deformation energy when basal implants are used in the mandible.	The immediate rigid implant splinting distributes peak forces.
Stefan Ihde *et al*. [16]	2008	Clinical study	To develop a model to accurately represent the interface between bone and basal implant throughout the healing process.	Basal implants undergo an intrinsic shift of maximum stress regions during osseointegration. There is a gradual shift from the early healing phase until full osseointegration is achieved.

Table 2. The main aims and findings of clinical case reports included in this review.

Reference	Year	Type of Study	Aims	Findings
Motaz Osman *et al*. [17]	2020	Case report	Rehabilitation of a 22-year-old female with a subtotal maxillectomy using an immediately loaded basal implant-supported prosthesis.	Basal implant restored the patient’s masticatory function, esthetics, and phonetics and improved the patient’s self-esteem and quality of life.
Fadia Awadalkreem *et al*	2020	Case report	Use of fixed basal implant-supported prostheses in irradiated bone, in conjunction with hyperbaric oxygen therapy.	Hyperbaric oxygen therapy in combination with basal implants is a successful treatment modality for patients with head and neck cancer who have a history of radiation therapy.
Fadia Awadalkreem *et al*. [19]	2020	Case report	Basal implant is used for full-mouth rehabilitation in a gunshot mandibular defect patient.	The fixed hybrid basal implant-supported prosthesis produced highly acceptable aesthetic and phonetic results and greatly improved the patient's life.
Abdelnasir G Ahmad [23]	2019	Case report	Basal implant-based full-mouth rehabilitation is used in a patient with cleidocranial dysplasia.	The basal implant-supported fixed prostheses improve aesthetics, speech, function, and overall quality of life.
Stefan Ihde [20]	2018	Case report	Immediate restoration is used with bicortical implants	The use of a cortically anchored strategic implant allowed for the fixed reconstruction of a severe defect to restore masticatory function to some extent.
Ilker Keskiner [24]	2016	Case report	This case report presents the surgical removal of basal-type dental implants due to failure of osseointegration.	Implants may be useful for severely atrophic alveolar bone, and the clinician should have the skill set and experience to overcome the potential complications associated with the removal of implants.
Mayur Khairnar *et al*. [26]	2015	Case report	Smooth polished surface bi-cortical implants are used in atrophied maxilla.	Observation of significant bone formation in severely atrophied jaws after indirect lifting of the nasal membrane with smooth polished surface bi-cortical implants.
Sumit Narang [21]	2014	Case report	The report highlights the placement of three bicortical screw implants into the extraction sockets.	Implants were placed and loaded immediately, which showed promising results at a follow-up of 6 months.
Meningaud *et al*. [25]	2009	Case report	Total oral rehabilitation with basal implants (cortically anchored disk-design implants) on a patient who received a facial allograft 1 year earlier.	The cortical anchorage only relies on this patient, allowing to avoidbone grafting. The particular thinness of the implant emergence limits the communication between the bone and the oral cavity to the minimum.
Kalinga K Sahoo [22]	2007	Case report	Placement of a bicortical screw implant to anchor a metal-ceramic crown in the missing right lateral incisor region and restoring esthetics.	The final restoration was outstanding except for the fact that the gingival emergence profile was missing.
S Ihde [1]	2001	Case report	Restoration of the atrophied mandible using basal osseointegrated implants and fixed prosthetic superstructures.	The basal osseointegration procedure allows speedy reconstruction of the masticatory function, and the cost of treatment is very moderate.

Table 3. Overview of the advantages and disadvantages of basal implants compared to conventional implants.

Aspect	Basal Implants	Conventional Implants
Advantages	-	-
Time	Less time needed	More time needed
Disadvantages	-	-
Evidence-Based	No sufficient evidence	Evidence-based practice
Retrievable	Not retrievable	Retrievable
Prosthetic solutions	No prosthetic solutions	All prosthetic solutions available
Surgical Technique	Invasive may reach the second cortical and could potentially affect vital structures, utilizing a blind, flapless technique.	Less invasive surgical procedure
Prosthetic Driven (Guided)	Surgical Driven inapplicable Prosthetic driven	Prosthetic-driven and computer guided
Preparation technique	High-speed drilling is necessary to penetrate the cortical bone, which may induce heat during the process.	Highspeed drilling is not necessary
Peri-Implantitis treatment	Inaccessible	Accessible and allows for the removal of the abutment and subsequent treatment.
Prosthetic preparation	Intraoral preparation induces heat plus bending the abutment, which may cause stress on the bone.	Abutments were prepared in the lab.
Single Implant	Not suitable choice	Suitable
Aesthetic	No Aesthetic guidelines	Well documented Aesthetic guidelines

Notably, no randomized controlled trials were found in the search, preventing the possibility of conducting a meta-analysis for this review. Additionally, the majority of the literature comprised case reports and follow-ups involving small case numbers. Regarding the evidence level of the reviewed papers, all fall under level V (Case reports, studies with no controls). Moreover, most papers were published in journals that were not indexed in Scopus and Thompson Reuters ISI databases.

4. DISCUSSION

The restoration of the edentulous maxilla or mandible typically involves dental implants, among which basal implants utilize the basal cortical portion of the jaws for retention. These implants have become a viable option for atrophied jaws, as they allow for immediate loading without extensive augmentation, making them particularly suitable for cases with limited bone [27]. Despite their potential, basal implants have not gained widespread trust among conventional implantologists due to limited data on their success rates. In our review, we identified only six clinical studies focusing on patient rehabilitation with immediate loading, lacking long-term follow-ups. Additionally, there were 11 low-evidence case reports emphasizing aesthetics and functions, with only one case report evaluating bone formation in severely atrophic alveolar bone after a one-year follow-up using cone beam imaging. While basal implants show promise in cases with insufficient bone [28], there is insufficient evidence to recommend them over conventional implants. Some dentists might opt for basal implants due to their lower cost and simplified work protocol.

This table provides a concise overview of the advantages and disadvantages associated with basal implants compared to conventional implants (Table **3**).

Further research on clinical cases is necessary to establish the efficacy of basal implants as a viable alternative to conventional implants.

CONCLUSION

Further research on clinical cases is necessary to establish the efficacy of basal implants as a viable alternative to conventional implants. The standard of care in dentistry should prioritize evidence-based practices, which commonly include the use of conventional implants. This review has limitations, notably the scarcity of clinical studies focused on basal implants and the inherent study design and follow-up limitations in most of the included papers.

AUTHORS' CONTRIBUTIONS

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to itssubmission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analysed during this study are included in the article.

CONSENT FOR PUBLICATION

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

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