Review Article

Comparison of Single-piece Basal Implants and Typical Single-root Implants: A Review

Susmita Mondal*, Sudheer Arunachalam, Sidhartha S. P. Behera, L. Srikanth, Gontu Sneha, Mesa Jwalithaclare

Department of Prosthodontics and Crown and Bridge, Sree Sai Dental College and Research Institute, Srikakulam, Andhra Pradesh, India.

Abstract

It is acknowledged that a one-piece implant design is a more solid idea because the implant and abutment are not connected. Minimal peri-implant bone loss can result from the absence of a microgap. In addition, there is a decline in mechanical issues such screw loosening and abutment fractures. Due to the great cortical stability of these implants, they can be inserted right away and put into immediate operation. By removing the abutment interface, the weakest link in the two-piece implant, the one-piece implant strengthens and stabilizes the prosthesis. The one-piece implant is a good option for individuals or surgery sites where there is insufficient bone to support a prosthesis as well.

Keywords: Advantages and disadvantages, Basal implant, Crestal implant, Surgical protocol, Types of basal implants.

Introduction

One of the initial alternatives for the prosthetic rehabilitation of edentulous and partially edentulous jaws over the past 20 years has been implant treatment. A two-piece dental implant from the original Branemark concept is intended to be utilized in a two-stage treatment process.[1] One-piece titanium implants were first made available on the market with a robust design for conventional and minimally invasive prosthetic procedures that allowed the restoration of single-tooth defects.[2] One-piece implants save time because a second stage of surgery is not necessary, and they require the least amount of treatment choices during the mucosal healing phase, exposing patients to less pain and discomfort overall. High initial stability is provided by the implant's novel geometries and cutting-edge surface morphology.[3] This is distinctive since it combines a surgical apparatus and a prosthetic component. The microgap is closed and transmucosal presence is constant.[4]

Meanwhile, advances in the science of implant dentistry led to technological advancements, such as better implant-threading patterns and surface treatments that have indubitably promoted greater primary stability and quicker recovery.[5] The standard crestal implants should be used when there is sufficient vertical and horizontal bone available because otherwise, the prognosis is poor if augmentation is included in the treatment regimen. Augmentation techniques frequently raise the dangers, expenses, and required number of operations of dental implant therapy. The term "basal implant," also known as "single-piece dental implant," "bicortical implant," or simply "cortical implant," refers to a contemporary implant system that uses the basal cortical region of the jaw bones for retention of dental implants that are specially made to fit in the basal cortical bone areas. The basal bone offers exceptional cortical bone quality for the retention of these distinctive and cutting-edge implants.[6]

The purpose of this review literature is to have increasing the knowledge around different types of single-piece implants, difference between conventional one-piece implant versus conventional two-piece implant (Table 1), the variations between crestal and basal implants in the treatment of atrophied edentulous jaws (Table 2), indications and contraindications of single-piece implant, advantages, and disadvantages in implant dentistry.

Morphology of Conventional Root-form Implant

Regarding the correct morphology, it has been determined that the integration zone has a combination of a cylinder

Access this article online

Website: www.jrad.co.in

DOI: https://doi.org/10.53064/jrad.2022.14.2.313

Address for correspondence: Susmita Mondal, Department of Prosthodontics and Crown and Bridge, Sree Sai Dental College and Research Institute, Srikakulam, Andhra Pradesh, India. Email: hasnasumi5@gmail.com

Received: Mar, 07, 2023; **Accepted:** Mar, 09, 2023; **Published:** Mar, 15, 2023

How to cite this article: Mondal S, Arunachalam S, Behera SSP, Srikanth L, Sneha G, Jwalithaclare M. Comparison of Single-piece Basal Implants and Typical Single-root Implants: A Review. J Res Adv Dent 2023;14(2):5-10.

Table 1: Difference between one-piece and two-piece implant

Parameter	One-piece implant	Two-piece implant
Morphology	The implant and abutment are fused together and produced as a single unit.	The abutment is distinct from the implant. If the implant's abutment is fastened to it by a screw, it might be viewed as having three pieces.
Surgical procedure	A single surgical session that is frequently flapless. The time needed for implant procedures is shorter than that needed for bridgework.	In two or three sittings over the course of 3–6 months, more complicated surgical operations are frequently required (e.g., implant placement, healing screw installation, and abutment placement).
Loading accommodation	Immediate loading, which means that the patient could receive the crown (s) or bridge (s) the very next day.	Delayed Loading: Before attaching a prosthesis to the implants, it is frequently required to wait at least 3 months.
Prosthodontic procedure	Like with normal bridgework, conventional impressions of the implants may be taken. It takes less time.	Similar to how traditional bridgework is created, conventional imprints of the implants are also possible. Shorter in duration.
Screw loosening	Absent: Because the abutment, screw, and implant are all part of one single unit.	Quite usual: The relationship between the root section and the abutment portion can be problematic because they are two separate pieces. Studies have shown that under oblique loading, mechanical stress is higher for two-piece implants.
From the patient's point of view	Crowns and bridges can be cemented in a day or two thanks to a less involved placement process that requires fewer sittings. More or less similar to a traditional bridgework, with costs that are similar to those of a traditional bridgework.	Only 3 months following the healing phase are crowns and bridges affixed to the teeth. Costing a great deal more than the standard bridgework
Long-term maintenance	The implant's strength is great because it is one solid piece and does not have a separate root or abutment. It is really easy to maintain. Maintenance is same to that for traditional bridgework.	The upkeep of these implants is more difficult. There may likely be some minor movement between the implant and the abutment; thus, screws (if used) must frequently be tightened at regular intervals.

Table 2: Comparison between basal and crestal implant[6]

Implant	Basal implant	KOS implant	Conventional implant
Indication	Used to restore numerous units, particularly in extraction sockets to allow insertion in bone with insufficient height and width.	Used for multiple unit repair, sufficient bone tissue, and excellent D1 and D2 bone are required.	Used to restore single or multiple bone units in sufficient bone tissue.
Mechanisms	Implanted tiny screws' cortical anchorage (bicortical screws, BCS). These implants' vertical surfaces can achieve excellent primary stability without corticalization – only osteoadaptation is required.	Such screw implants may cause lateral condensation of spongy areas. A mechanism that could be described as "corticalization" of the spongy bone significantly boosts implant stability.	Osseointegration is defined as "the development of a direct interface between an implant and bone, without the need for intervening soft tissue".
Implant procedure	72 h implant process Surgery performed in one sitting and flapless (no open surgery is required). The time needed for implant procedures is shorter than that needed for bridgework.	72 h implant process surgery performed in one sitting and flapless (no open surgery is required). The time needed for implant procedures is shorter than that needed for bridgework.	In two or three sittings over the course of 3 to 6 months, more complicated surgical operations are frequently required (e.g., implant placement, healing screw installation, and abutment placement).
Cost	Cost effective as well	cost effective as well	cost
Armamentarium	Simple-the implant surgery kit contains just a few basic tools.	Simple-the implant surgery kit contains just a few basic tools.	Complex-the installation of two-piece implants requires a variety of devices.
Prosthetic procedure	Really easy as with ordinary bridgework, conventional imprints of the implants can be taken. Very little time spent seated.	Really easy as with ordinary bridgework, conventional imprints of the implants can be taken. Very little time spent seated	Requires more chairside time and more difficult procedures.
Long maintenance	Excellent single-piece strength supplied by the implant	Excellent single-piece strength supplied by the implant	The relationship between two pieces can occasionally lead to issues.
From patient's point of view	simpler positioning technique	simpler positioning technique	Difficult positioning technique
Size and design	There are many different sizes and designs available.	There are many different sizes and designs available.	There are only a few sizes and designs available.
Utilized bone	More dense, calcified, and less prone to bone resorption is seen in basal bone.	More dense, calcified, and less prone to bone resorption is seen in basal bone.	Bone in the crestal alveolar region is of lower quality and more susceptible to resorption.
Suitable for the patient	Nearly all patient	Nearly all patient	Not recommended for people who are diabetic, smokers, or have unmanaged periodontitis

and a cone as well as a hemispheric form for the apical zone. The conical zone offers a progressive adjustment so much of pre-fit as of the height of emergency of the implant, and the smooth cylindrical structure in the first half of the implant permits an easy adjustment to the axis of insertion of the bed.

The three schematic sections of the implant's design are the "Area of Integration," the "Exposed or Neck Area," and the "Pillar or Area of Restoration." The area of integration, also known as the apical area of the implant, is the part of the implant that is directly in touch with the bone. This region is distinguished by a cylindrical form in the middle of its length and a conical form at one-third of its overall length. For all implants, the neck, or exposed portion, remains the same height or length, with the curvature's degree only changing. All implants can be installed, because the restoration area is the same for all of them. In addition, this region serves as the piece or repair component's reception surface.[7]

Morphology of Single-piece Basal Implant

Basal osseointegrated implant (BOI) implant morphology

Either pure titanium or a titanium-molybdenum alloy is used to make BOI implants. They come in either one or two pieces.

- Abutment portion – The conical abutment component of single-piece BOI implants is left exposed in the oral cavity.
- Neck – It is the area located immediately beneath the abutment part. This portion's diameter may or may not be restricted.
- Vertical shaft – This links each implant's parts together. To prevent plaque buildup and inflammation, the shaft is constantly polished and squeaky-clean.
- Crestal disk – That is the implant's initial disc. It is known as a crestal disc because, on implant placement, it rests in the crestal bone.
- Basal disk – Being a load bearing and distributing component, this element is also kept polished. Elasticity allows for a 15–25° bend in the portion of the shaft that is attached to the basal disc. It typically takes 5 mm to separate the crestal and basal discs.

The surface of the KOS and KOS Plus implants is treated (sand and grit blasting followed by acid etching); however, the implant neck of the KOS implant is kept in high polish. The neck of the KOS Plus implant and the basal cortical screw portion is kept in high polish.[8]

Different Types of Single-piece Basal Implants[9]

Today, there are four common types of basal implants available (Figure 1):

1. Screw Form
2. Disk Form
3. Plate Form
4. Other Forms

1. Screw Form
   a. Compression Screw Design (KOS Implant)
   b. Bi-Cortical Screw Design (BCS Implant)
   c. Compression Screw+BCS Design (KOS Plus Implant)

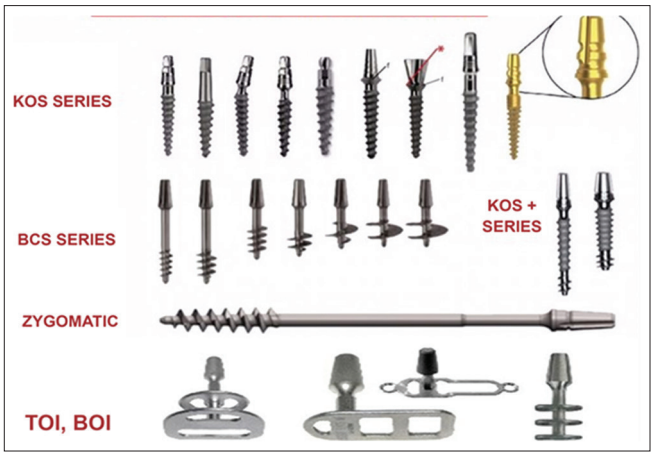

Figure 1: Different types of basal implants

2. Disk Form
   a. BOI
   b. Trans-Osseous Implant
   c. Lateral Implant
3. Plate Form
   a. BOI-BAC Implant
   b. BOI-BAC2 Implant
4. Other Forms
   a. TPG Implant (Tuberopterygoid)
   b. ZSI Implant (Zygoma Screw)

Limitations of Conventional Root-form Implants: [10]

1. Demands a significant amount of bone.
2. Wider bone is needed at the crest to accommodate the neck, which is frequently deficient due to bone loss.
3. Generally necessitate bone augmentation treatments at the time of or before implant installation, increasing expense, surgical time, the number of surgeries necessary, and the length of the treatment.
4. The majority of the implant is inserted into spongy, low-density bone that cannot be loaded right once and may take 3–8 months to mend.
5. These implants may necessitate significant bone augmentations (sinus augmentation, block grafting, and nerve repositioning), numerous surgical processes, greater costs, and prolonged healing times due to critical jaw structures such as the maxillary sinus and mandibular canals.
6. It has a screw connection that could cause future issues with screw loosening or screw breakage under the prosthesis.
7. These implants have a rough surface that is prone to collecting infection when exposed to the oral environment or when implanted in an affected area. Since the tooth socket is contaminated, these implants cannot be inserted there.
8. Crestal bone loss may result when the bone crest experiences its highest level of stress or pressure.

9. These implants' wide neck diameter and rough surface call for thick, keratinized, stable, and non-mobile gums around the neck to prevent issues with soft tissue.

Indications of Basal Single-Piece Implants: [11]

1. There are several different circumstances in which numerous teeth are lost or must be pulled.
2. When bone augmentation or the two-stage implant implantation operation has failed.
3. Horizontally or vertically, depending on the severity of the bone shortage.

Contraindications of Basal Single-Piece Implants

1. Special Cases: Situations in which it is impossible to arrange bilateral equal mastication, such as when the chewing muscles or their innervations, are partially absent (these situations may cause issues with instantaneous load procedures).[6]
2. Medical conditions: Dental implants cannot be placed in a number of cases due to medical issues. Recent myocardial infarction (heart attack) or cerebrovascular accident (stroke), immunosuppression, are a few of these disorders (a reduction in the efficacy of the immune system).[12]
3. A dentist will require a thorough list of all the medications and dietary supplements that their patient is taking. Concerning medications include those used to treat cancer, those that prevent blood clotting, and bisphosphonates (a kind of medication used to treat osteoporosis).

Advantages of Conventional Root-form Implant

1. Between the implant and abutment, there is no microgap that may support bacteria.
2. After implant integration, there is no longer a requirement to replace healing caps or cover screws for abutments at the implant level.
3. Immediate loading is the another advantages of one-piece implant placement.
4. The flapless procedure dramatically lessened the amount of discomfort and post-operative edema.[1]

Advantages of One-Piece Basal Implants

1. Basal bone allows for safe load transmission because it is free of infections. Load transmission occurs close to the site of bacterial assault in traditional root-form implants. Due to increased mineralization, cortical bone is resistant to resorption.
2. Less frequently occurring peri-implant infections-basal implants have a polished implant surface, and their mucosal penetration diameter is smaller than that of traditional dental implants.
3. Alveolar bone from the patient must be used for the implant's base. Bone augmentations are not necessary. Even though their vertical height is decreased, all patients have enough basal bone on the horizontal plane. In addition, the length of the procedure is shortened because bone augmentations need time to heal.[6]
4. Restorative solution that is both esthetically beautiful and/or acceptable and psychologically advantageous, increasing patient acceptance.[13]
5. The masticatory pressures are effectively allocated to locations that are very resistant to resorption because they are embedded in high-quality basal bone.[14]

Disadvantages of Conventional Root-form Implant

1. Abutments are not customizable. The abutment with implant is made by the firm. Hence, there can be no customization.
2. The patient's mouth used to receive a lot of trimming and abutment shaping from the operator. This results in a lot of titanium dusting, which should not be ingested. Only direct impressions (Impressions must be made directly), which will take a lot of time and require the patient to keep their mouth open for an extended period of time, which is stressful for the implant patient. If the mouth is full, a lot of chairside labor is required. In traditional implants, this issue can be avoided.
3. Airotor handpieces with Tungsten carbide burs are used to mill abutments for single-piece implants, but this method is imprecise and generates a lot of frictional heat, which is bad for osseointegration and bone repair surrounding the implant.
4. The risk of a flapless operation is that the implant surface may become contaminated or that epithelial or connective cells may deposit in the bone hole and prevent osseointegration.[1]

Disadvantages of Basal Implant

1. Single tooth replacement compromises appearance.
2. For a surgery to be effective, a skilled surgeon with solid anatomical understanding is necessary.
3. Excessive decrease of sound bone when there is excellent bone support.[6,9]
4. Localized microcracks in the cortical bone are caused by the masticatory stresses that are conveyed through the basal implants to an enossal site.[15]

Drilling Protocol of Conventional Root-form Implant (Adin)

1. Standard drilling procedures are described by Adin for full bone conditions, or situations where implants have been inserted and are totally covered by bone.
2. When this mode of therapy is indicated, adhering to these protocols will produce implants sturdy enough for immediate loading. It should be noted that the success of instant loading treatments depends not only on the

durability of dental implants but also on prosthetic procedures that are solely the dentist's responsibility.

3. To provide acceptable implant initial stability in soft bone circumstances, it is advised to take into account a drill size decrease of one (in comparison to typical drilling protocols). The self-tapping characteristics and conical form of the implants enable bone condensation during implantation into small osteotomies while allowing for a smooth insertion. In addition, it is advised in these situations to drill 1–2 mm less than the desired implant's overall length. Further bone cutting into the final depth is made possible by the active apex. To avoid harming nearby structures during this treatment, surgeons must take extra care (Figure 2).
4. It is advised to create an osteotomy in dense bone circumstances that is 1 mm longer than the desired implant's length. The self-drilling capabilities of the implant should not be used in these circumstances.
5. When installing Adin dental implants, NEVER use more torque than 50N cm.
6. Sharp tools should be used for all drilling and pre-tapping operations, and there should be frequent irrigation.

Surgical Procedure of Basal Implant

Basal implants use a different surgical technique than typical implants. The procedure is straightforward and uncomplicated to carry out, and it avoids thermal harm by not drilling deeply into the bone. External irrigation is used throughout the procedure, and for almost all cases, a single pilot osteotomy using a "Pathfinder Drill" is sufficient for KOS, KOS Plus, and BCS implants. The kit also includes manual drills for a controlled osteotomy preparation.

The immediate loading of these implants is another factor to take into consideration; a sutured site is not a favorable area to receive an immediate prosthesis. Basal implantologists do not recommend raising a flap for these implants, because it results in a decreased blood supply and also because doing so would be pointless given the design of these implants.[6,8]

According to ROOTT implant system – Drills are used to establish the implant bed while under local anesthesia. It is advised to utilize ROOTT drills and follow the methods for preparing the bone bed to prepare the implant's proper bed. Before trying installation, it is advisable to study the IFU of the drilling procedure with regard to the rotations per minute, intermittent drilling approaches, and proper cooling.

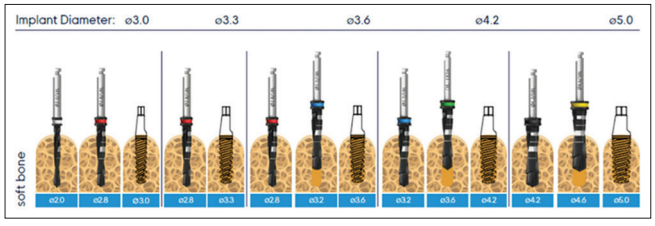

Figure 2: Drilling protocol of conventional root-form implant (Adin)

Both the handpiece and the ratchet can be used to manually implant a root implant. The following torque restriction is advised:

- BASAL implant from 3.0 mm in diameter, inserted directly never go above 117 Ncm
- BASAL implant from 4.5 to 5.0 mm in diameter, inserted directly do not go over 238 Ncm
- BASAL implant from 5.5 mm in diameter, inserted directly never go above 298 Ncm

Conclusion

The adoption of one-piece implants with meticulous treatment planning and a less invasive insertion approach undoubtedly helped the patient accept the treatment plan and restorative solution.[16] This one-piece implant is a promising treatment choice, as evidenced by the high implant survival rate, stable bone level, and positive outcomes in terms of appearance and soft tissue.[17] On the other hand, basal implants are a great substitute for dangerous bone augmentations because, in most cases, they allow for rapid loading. Even for individuals with managed diabetes, chronic destructive periodontitis, and smokers, they make dental implant procedures affordable, accessible, and safe. Therefore, it can be said that basal implantology gives the surgeon the tools that they need to improve the quality of life for patients who require fixed rehabilitation.[18]

References

1. Prithviraj DR, Gupta V, Muley N, Sandhu P. One-piece implants: Placement timing, surgical technique, loading protocol, and marginal bone loss. J Prosthodont 2013;22:237-44.
2. Wagner G, Hartung D. One-piece titanium implants: Retrospective case series. Case Rep Dent 2021;2021:6688355.
3. Diederich H. Minimal treatment options with one-piece implants.
4. Durrani F, Nahid R, Pandey S, Singh P, Pandey A. One-piece implants: Careful approach for complex rehabilitation. Natl J Maxillofac Surg 2021;12:266-70.
5. Hahn J. One-piece root-form implants: A return to simplicity. J Oral Implantol 2005;31:77-84.
6. Ali SM, Mahmud PK, Othman KS, Samad AA. Single piece dental implant: A remedy for atrophic ridges. Int J Otolaryngol Head Neck Surg 2019;8:271-82.
7. Zincir ÖÖ, Parlar A. Comparison of stresses in monoblock tilted implants and conventional angled multiunit abutment-implant connection systems in the all-on-four procedure. BMC Oral Health 2021;21:646.
8. Gupta AD, Verma A, Dubey T, Thakur S. Basal osseointegrated implants: Classification and review. Int J Contemp Med Res 2017;4:2329-35.
9. Pathania N, Gill HS, Nagpal A, Vaidya S, Sailo JL. Basal implants-a blessing for atrophied ridges. IP Ann Prosthodont Restorative Dent 2021;7:16-21.
10. Shahed SS, Nagaral SC, Mujawar AM. Basal Implants: A breakthrough for atrophic ridges. J Appl Dent Med Sci 2018;4:50-4.
11. Rahul S, Jai P, Dhruv A, Anurag H. Basal implants-an alternate treatment modality for atrophied ridges. IJRID 2016;6:60-72.
12. Sharma R, Prakash J, Anand D, Hasti A. International journal of research in dentistry basal implants-an alternate treatment modality for atrophied ridges.
13. Chung S, McCullagh A, Irinakis T. Immediate loading in the maxillary arch: Evidence-based guidelines to improve success rates: A review. J Oral Implantol 2011;37:610-21.
14. Kumar K, Kumar S, Singh R, Vaibhav V, Kedia NB, Singh AK. Basal

implants-a new era of prosthodontic dentistry. IP Ann Prosthodont Restor Dent 2020;6:1-3.
15. Nair C, Bharathi S, Jawade R, Jain M. Basal implants-a panacea for atrophic ridges. J Dent Sci Oral Rehabil 2013;2013:1-4.
16. Bilichodmath S, Shivanand S, Singh N. Immediate loading of onepiece root form implant: A case report with 3 years' follow-up. J Health Sci Res 2018;7:16-8.
17. Christopher SD, Savitha AN. One-piece implant in reduced edentulous space closure: A report of two cases. Contemp Clin Dent 2013;4: 563-5.
18. Patel K, Madan S, Mehta D, Shah SP, Trivedi V, Seta H. Basal implants: An asset for rehabilitation of atrophied resorbed maxillary and mandibular jaw-a prospective study. Ann Maxillofac Surg 2021;11: 64-9.