SINGLE - PIECE DENTAL IMPLANTS

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INTRODUCTION

Implantology is a distinctive branch of dentistry deals with rehabilitation of edentulous arches in an idealistic manner regardless of atrophy or injury to stomatognathic system. Evolution of implant dentistry has occurred in innumerable manner since last few decades and also gained vast demand in the field of dental reclamation.

Restoring the edentulous arch with the use of implants has a certain amount of predictable success. However, to perform hassle free and affluent implant surgery, the critical requirement is sufficient bone should be available i.e minimum 13-15mm length and 5-7 mm width. If the criteria are not fulfilled than conventional implants might not be very successful, and we need an alternative treatment plan which restoring the lost alveolar dimensions [1].

To overcome the hurdles in restoring atrophied jaw bones, “Basal Implants” were developed and successfully placed. Basal implant also known as lateral implants or disk implants, works on the principle of utilizing basal cortical bone areas which is exempt from infection and

resorption. The reason being for engaging cortical bone is that its load bearing tolerance is much higher than that of the spongious bone.

Over the years basal implants have been developed and improved in several stages by majorly the German and French dentists. The first single piece implant was developed and used by Dr. Jean-Marc Julliet in 1972 and has been used to this very day successfully, the only disadvantage is the lack of a surgical kit4, 6. To overcome this disadvantage in mid 1980s French dentist Dr. Gerard Scortecci improved the basal implant system with matching surgical tools and external and internal connections for the prosthetic superstructure; he called them “Diskimplants”.

Since 1990s several interested German dentists developed new implant systems and surgical tools based on Dr. Gerard Scortecci’s Diskimplant, this gave rise to the development of the modern Basal Osseointegrated Implant (BOI), also known as Lateral Implant. These implants were designed to enable masticatory load transmission in the vertical as well as its basal part.

Basal implantology is also known as just cortical implantology or bicortical implantology or refer as modern implantology system that utilizes the basal cortical portion of the jaw bones for the dental implants retention which are uniquely designed to be accommodated in the basal cortical bone areas [6].

These were introduced to offer a mechanically robust design that allows for both minimally invasive and conventional prosthetic approaches, particularly in single-tooth replacements. The unibody construction eliminates the microgap typically seen in two-piece implants, potentially reducing bacterial colonization and marginal bone loss. Onepiece implants offer several advantages, such as a strong, unified structure, simplified surgical procedures (flap or flapless), and easier prosthetic workflows. Additionally, the implant–prosthetic interface is located farther from the bone, which may be beneficial in certain clinical situations. They can be placed immediately in fresh extraction sockets or after healing, and are suitable for immediate loading when high primary stability is achieved.

Theoretical framework

Dental implants are generally categorized into one piece and two piece. The one-piece implant consists of an implant and abutment as a single unit. The two-piece is similar to traditional

implant, where the abutment may be screwed or cemented in place [23]. Currently, most available research has been completed for one-piece zirconia implants, which show superior mechanical properties relative to two-piece implants.

The type and extent of modification of zirconia implant influences the fracture resistance which evaluates the effects of cyclic loading and finish line design on the fracture strength of one-piece zirconia implants and it is shown that a chamfer finish line along with cyclic loading decreases the fracture strength of zirconia implants [24].

Single piece implants is a type of dental implant that has been developed to address the challenges of conventional implants in patients with poor bone quality or quantity. Single piece implants have gained popularity due to their unique design and high success rate. Characteristics of single piece implants are as follows:

Implant design: Single piece implants have a unique design that differs from conventional implants. Single piece implants have a wider base and a tapered design, which allows for immediate stability and anchorage in cortical bone [25]. The implant design also allows for immediate loading and osseointegration.

a) Tapered design: Allows for better anchorage in cortical bone. The tapered design also allows for better stress distribution and reduces the risk of implant failure. The implant design also allows for immediate stability and anchorage in cortical bone, which allows for immediate function and osseointegration.

b) Wide base: Have a wider base compared to conventional implants which provides better stability and anchorage in cortical bone, which reduces the risk of implant failure and also allows for better stress distribution and reduces the risk of bone loss [26].

c) Bicortical anchorage: Rely on bicortical anchorage for stability and anchorage. The implant is placed in a way that it is in contact with both the cortical and cancellous bone, which provides better stability and anchorage and also allows for better stress distribution and reduces the risk of implant failure.

d) Immediate loading: Allows for immediate loading and osseointegration which reduces the

treatment time and cost for patients [27]. The implant design of basal implants allows for immediate stability and anchorage in cortical bone.

e) Biocompatible materials: They are made of biocompatible materials such as titanium, zirconia or ceramic and have been shown to be safe and effective for dental implant placement with a high degree of osseointegration [28].

Applications of single piece implants:

Single piece implants are versatile and can be used in a variety of applications, including:

- **Full-arch restoration**: Single piece implants can be used to support a full arch of teeth, either on the upper or lower jaw. This is particularly useful in cases where patients have lost all or most of their teeth [25].

- **Single-tooth replacement**: Single piece implants can be used to replace a single missing tooth. This is a good option for patients who cannot have traditional implants due to lack of bone density or volume [23].

- **Multiple teeth replacement**: Single piece implants can be used to replace multiple missing teeth, either with individual implants or with implant-supported bridges.

- **Immediate loading**: Single piece implants are designed to allow immediate loading, which means that a crown or bridge can be placed on the implant right after surgery. This can reduce the overall treatment time for patients.

- **Orthodontic anchorage**: Single piece implants can be used in orthodontics to anchor braces or other orthodontic appliances.

Rationale for using single piece implants:

Single piece implants also known as basal osseointegrated implants, are a type of dental implants that utilizes the cortical bone as the primary anchorage for support. This type of implant has gained popularity over the past few decades due to its high success rates, minimal

invasiveness, and ability to support immediate loading.

1. Bone quality and quantity: They are designed to be placed in the cortical bone, which has higher density and strength compared to the trabecular bone.**2. Reduced invasiveness**: Typically placed using a minimally invasive approach, which involves a small incision and minimal bone removal. **3. High success rates**: High survival rates and low complication rates. **4. Immediate loading**: Support immediate loading, which means that a patient can receive a fixed prosthetic restoration soon after the implant is placed. **5. Cost-effective**: Alternative to traditional implant systems, especially in cases where multiple implants are needed [26].

Advantages of single piece implants

1. One piece implant – Ensures the minimization of the failure of the implant due to interface problems between the connections that exist in conventional two- and three-piece implants.**2. Basal cortical bone** -These implants acquire support from the basal bone which is generally more resistant to resorption unlike the crestal bone, where the conventional implants are anchored. **3. Additional surgeries**: Anchored in the basal bone and not in the crestal bone, there precludes the need for additional surgery such as bone augmentation / grafting, sinus lifting and nerve transpositioning procedures [28]. **4. Implant load distribution**: Implant load is safely transmitted to the free basal bone, while in conventional root form, there is a risk for bacterial attack.**5. Peri-implantitis:** There is negligible risk for peri-implantitis or peri-implant disease because of the polished surfaces in implants [26].**6. Loading protocol:** Immediate loading can be performed in a single piece implant. There are no edentulous phase and no need for immediate dentures.

Disadvantages of single piece implants:

It is always advisable to keep a few more extra implants handy to avoid extensive planning including three-dimensional exploration of bone conditions and the technique is pretty complex and it poses substantial challenges, for instructors and users [27].

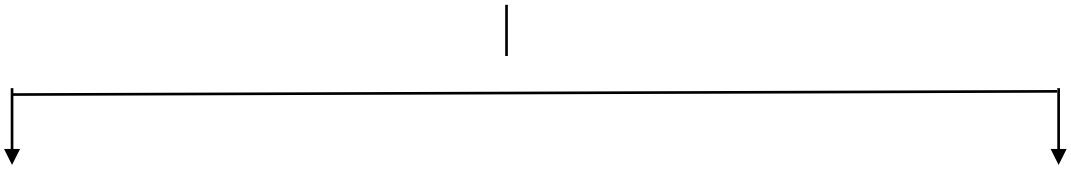
Complication of single piece implants:

Functional overload osteolysis: Masticatory forces transmitted through the single piece implants may create local microcracks in the cortical bone which are repaired by formation of secondary osteotomes, a process called as remodelling.

The crestal bone is less dense in nature and is exposed to infections from tooth borne pathologies, injuries or iatrogenic factors and is therefore subject to higher rate of resorption whereas the basal bone is heavily corticated and is rarely subject to infections and resorption.

Classification of Single -piece implants

Based on morphology



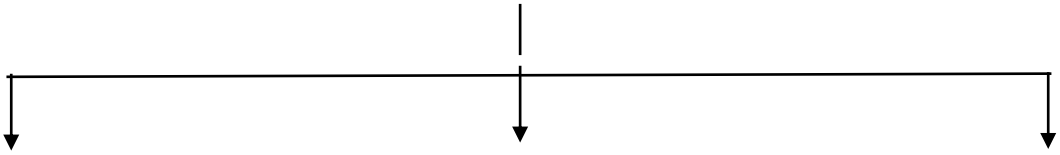
Screw form

a) Compression screw design
b) Bi -cortical screw design
c) Compression screw + Bi – cortical screw design
d) KOS plus implant

Disk form

a) Basal Osseo integrated Implant (BOI) / Trans-Osseous implant (TOI) / Lateral Implant

According to abutment connection



Single Piece Implant

External threaded connection

Internal threaded Connection

a) External Hexagon.
b) Internal Octagon.

According to basal plate design

Basal disks with angled edges

Basal disks with flat edges / S-Type Implant

According to number of disks

Single disk

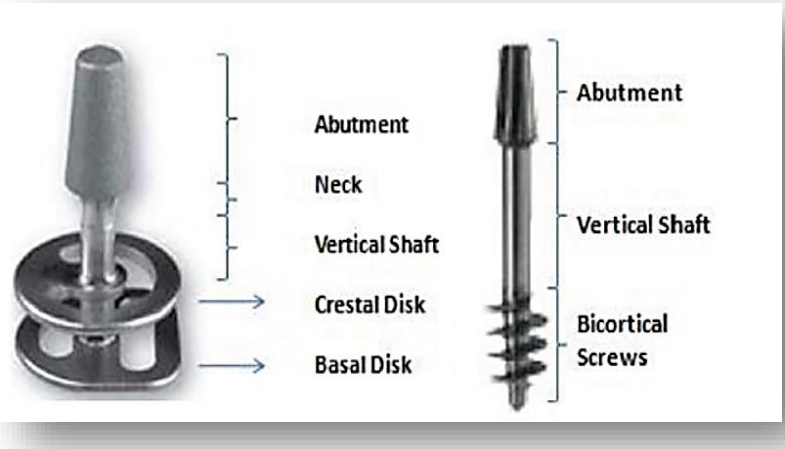
Double disk

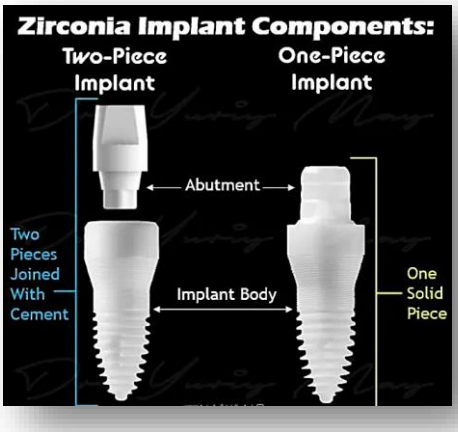
Triple disk

Other forms

TPG Implant (Tuberopterygoid)

ZSI Implant (Zygoma Screw)





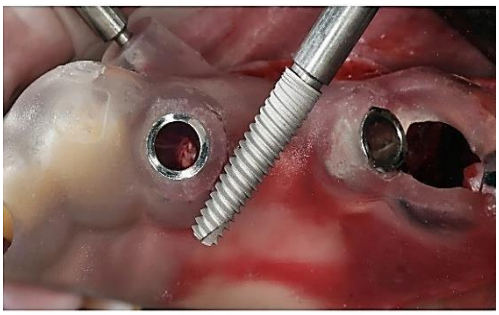
Indications and contraindications of single piece implants:

Indications	Contraindications
• Missing or extraction of several teeth • Failure of two-stage implant process or bone augmentation • Bone atrophy (knife edged, thin ridges, insufficient bucco-lingual thickness or bone height	• Medical related conditions (Myocardial infarction, cerebrovascular accident, immunosuppression) • Drugs or medications such as anti -cancer drugs & blood thinners. • Bisphosphonates such as alendronate, zoledronate for the treatment of osteoporosis.

Surgical technique for single piece implants:

Single-piece implant osteotomy are technique sensitive and strict manufacturer guidelines should be followed. Initial osteotomy was at 2500 rpm to the required depth (12 mm) with 1.9 mm width drill. The second osteotomy was with 2.3 mm width drill at reduced rpm of 1500 rpm for full depth. Third osteotomy drill of 2.7 mm width at 800 rpm was half length of the initial created depth (7 mm). Two Crestone one-piece implants (Tag Dental, Israel; 3 mm × 11.5 mm) with interdistance of 3 mm and 1.5 mm from the adjacent teeth were placed.

It is a one-stage surgical technique that involves placing the implant directly into the basal bone with minimal bone preparation.[23] The implant is placed in a way that it is in contact with the cortical bone, which provides stability and anchorage. The implant can be loaded immediately after placement, which allows for immediate function and osseointegration.



Conclusion

Single piece implants, also known as single-stage or one-piece implants, are dental implants designed as a single unit, combining the implant body and abutment in one piece. This design streamlines the implantation process and can offer several advantages such as simplicity, reduced infection risk, immediate functionality, stability and less bone loss.

However, there are considerations, such as the need for sufficient bone volume and careful planning in placement, as these implants may not be suitable for all patients or cases. Overall, single piece implants can be an efficient option for specific dental restoration needs.

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