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Review Article

BASAL IMPLANTS: AN ALTERNATE TREATMENT MODALITY FOR THE HOPELESS- A REVIEW ARTICLE

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A B S T R A C T

Basal implants were developed primarily for immediate use in the atrophied jawbone. There are no difficult or impossible cases for implantologists familiar with basal implants, and their use leads in all cases straight to the desired treatment result. As the use of Basal implants can help avoid risky and expensive bone augmentation procedures, these implants are the therapy of first choice in moderately or severely atrophied jaws as well as in those cases, where immediate loading or cheaper treatments are desired by the patient. Neither, intraoperative nor preoperative infection will normally threaten the treatment result, since suppuration from the osteotomy slot is usually uninhibited at all times. With respect to the principle of "*primum nihil hocere*", i.e limiting treatment, basal implants should be devices of first choice, whenever unpredictable augmentations are part of an alternative treatment plan.

Aim: The purpose of this review is to evaluate the biomechanical aspects of Basal and Conventional implant designs on the quality and strength of osseintegration, bone- implant interface and their relationships to the long term success of the prosthesis.

Study design: A systemic along with a manual search of articles was conducted in Pubmed, Google scholar and major journals published from 1987 to 2017 on basal and conventional osseointegrated implants. The era was divided into three decades and the number of ideal cases for the study irrespective of the pre- prosthetic surgeries were taken into consideration.

Results: The technique of basal implantology solves all problems related with conventional implantology and is a customer oriented therapy meeting patients' demands successfully. Within the duration of this study it was indicated that the restoration of atrophic ridges by basal osseointegrated implants is efficient and a good alternative to conventional implants as the treatment is simpler, quicker and requires no bone augmentation procedures.

INTRODUCTION

Newer concepts and procedures in every aspect of medicine supplemented by technological superiority have contributed in a longer and healthy life. Increase in life expectancy has also led to an increase in the number of the aging population. Most of this aging population have the problem of partial or complete edentulousness. Severe alveolar bone resorption can occur after tooth removal. This is particularly true for the complete removable denture wearer[1]. Partially or completely edentulous patients are left with replacement options like removable appliances, fixed bridges and dental implants.

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In the past few decades, the widespread availability and successful use of dental implants have greatly expanded the treatment options for replacement of missing teeth[2].

Treatments with dental implants require adequate bone width and height. When these conditions are absent; additional surgical procedures are necessary to create adequate bone volume and reconstruct the alveolar ridge like Guided Bone Regeneration (GBR), Block Bone Grafting (BBG) and Distraction Osteogenesis (DO) and sinus lifting to overcome these anatomical and mechanical conditions. Generally, these measures are more time-consuming and expensive than the patient can afford. Meanwhile, no implant treatment is performed whatsoever, and the patient is left without an adequate fixed restoration. Due to the additional cost of these adjuvant measures, many patients are unable to afford adequate implant treatment. The consequence is that their true

masticatory function cannot be restored in a truly comprehensive manner[3].

The term 'basal implant' refers to the principles of utilizing basal bone areas free of infection and resorption, and the employing of the cortical bone areas. Treatment with Basal implants is simpler and quicker than conventional implant therapy since no augmentation procedures are invloved[3]. This article discusses the types of basal implants, comparison of basal with conventional implants, advantages, disadvantages, limitations, advantages, disadvantages and review of literature on basal implants.

History

Basal implants were developed and improved in various stages through the efforts of the German and French dentists primarily (Table 1).

Basal versus Conventional dental implants

The macrodesign or shape of an implant has an important bearing on the bone response; growing bone concentrates preferentially on protruding elements of the implant surface such as ridges, crests, teeth, ribs, or the edge of threads, which apparently act as stress risers when load in transferred. The shape of the implant determines the surface area available force stress transfer and governs the initial stability of the implant. Finite element analysis studies of implants indicate that bone stress distributions and magnitudes vary with implant shape[6]. The significance in increased implant length or its ability to achieve osseointegration is not found at the conventional bone interface, but rather in initial stability and the overall amount of bone–implant interface.

Table 1 Evolution of Basal Implants over The Years

Serial number	Contributor	Year	Contribution
1	Dr. Jean- Marc Julliet[4]	1972	Single piece implant; no basal plate resilience.
2	Dr. Clunet Coste	1975	Patent for manufacturing technique of a T- shaped single basal implant unit.
3	Mr. F. P. Spahn	1977	First enossal implant design that relied on a lateral insertion path and capitalized on the stability of the inner and outer cortical plates.
4	Dr. Gerard Srortecci[3,5] (French Dentist)	1983	Founding father of lateral implantology; improved basal implant system with matching cutting tools known as 'DISKIMPLANTS'; two types: Internal and External connectors attached to prosthetic superstructure; implant system had its own insertion tools; rotationally symmetrical design of the implant.
5	Dr. Stefan Ihde	1997	Lateral basal implants were developed; fracture proof base plate design; bending zones were introduced into the vertical implant shaft.

Table 2 Differences between Conventional and Basal Implants

Serial number	*Criteria*	*Conventional implants*	*Basal implants*
1	Success rates	98-99%	95%
2	Loading	Delayed; In multiple stages	Immediate
3	Surgeries	Multi-stage; open placement protocol; time consuming.	Single stage; Key-hole placement protocol; time efficient.
4	Duration of procedure	3-8 months (approximately)	72 hours (approximately)
5	Additional surgery (Bone augmentation, grafts, sinus lift)	Required in atrophic ridges.	Not required.
6	Bone support	Crestal bone	Cortical bone
7	Load distribution	Load transmission occurs in vertical direction.	Load transmission occurs in a horizontal direction.
8	Design	• Tapered shape; greater apical torque; increased bone compression; rigidity and stability. • Threads transfer the shear forces into more resistant forces at bone interface and hence decrease shear at the implant-tissue interface; long term success. • Increased length provides reistance to torque when the abutments are screwed; larger surface area to dissipate the occlusal forces.	• Cortical anchorage of the implant garuntees for safe load transmission and osseointegration. • Wider, disk like design increases the surface area to dissipate occlusal load; greater area of bone contact than narrow implant designs. • Increased diameter and non-axial design reduces the development of shear at implant- tissue interface and improves healing in low density bone sites.
9	Association with surrounding structures	Higher risk of perforations and damages.	Negligible risks due to improved design.
10	Surface and bacterial colonization	Smooth surfaces on two- third implant units; have greater potential to harbour bacteria thereby increasing the risk of peri-implantitis; infection spreads along the path of load distribution.	Smooth surfaces on the long shafts of the basal implant; do not permit bacterial colonization and hence eliminate the incidence of peri-implantitis completely; infection does not spread along the path of load distribution.
11	Total number of implants	Generally 8-10 implants (approximately) are required per arch for full mouth rehabilitation.	6- 8 implants (approximately) are required per arch for full mouth rehabilitation.
12	Modification	There exists no possibility to modify the implants in- situ.	Possible to modify the implants in-situ and compensate skeletal discrepancies.
13	Types	Threaded; non- threaded; cylindrical; pressfit; can be hollow or solid; parallel or conical; flat or pointed in design.	Basal osseointegrated implant (anterior/ posterior); basal cortical screw; external basal implants.
14	Surgical technique	• One stage surgery. • Soft tissue reflection; incision is made over the crest of the ridge; Vertical and horizontal osteotomy T shaped cuts; lateral cutters to create dimensions of the osteotomy; twin cutters are used in cases of double disk implants; abutments with apically positioned neck area of 4mm length can be used in the transitional zone of the implant.	• One versus two stage surgery. • Soft tissue reflection; incision is made over the crest of the ridge; precision surgical stents are drilled; the implant can be screwed or self tapped with a torque controlled wrench; gingival is adapted around the healing abutment; final prosthesis is restored after a healing period of 3-8 months.

Basal implants are of two types: Basal osseintegrated and Basal cortical screw type implants. Despite acceptable success rates, these approaches involve unpredictable degree of morbidity at the donor and recipient sites and poor prognosis.

Thus, basal implants were specifically designed to utilize strong cortical bone of the jaw without risk of infection[3].

The differences in design, mechanism, osseintegration and success of basal and conventional implants are illustrated in Table 2.

Disadvantages of conventional implant [7, 8]

- Requires large amount of bone and hence, generally requires bone augmentation surgeries which increases the cost and time of surgery.
- Mostly placed into poor density spongy bone which cannot be loaded immediately therefore requires healing time of 3-8 months approximately.
- Has a screw connection which may lead to future screw loosening/ breakage under the prosthesis.
- Sensitive infection due to its rough surface area and vertical path of load distribution.
- Maximum load/ stress are over the crestal bone which results in crestal bone loss.
- Wider neck diameter makes it difficult for soft tissue re-epithelisation.

Advantages of Basal implants[7]

- Single/ monobloc unit
- Utilizes basal cortical bone for support.
- Efficiently used in atrophic and compromised bone conditions.
- Better distribution of masticatory forces.
- Lesser peri-implantitis evidence.
- Better results in medically compromised patients like Diabetics or patients having chronic periodontitis.

Indications of Basal Implant[7]

- In situations when multiple teeth are missing or have to be extracted.
- When a bone augmentation procedure has failed.
- Cases of thin ridges – That is deficiency of bone in buccolingual thickness.
- Cases where bone height is insufficient.

Contraindications of Basal Implants[5]

- Medical conditions like recent myocardial infarction, cerebrovascular stroke, immunosupression, Patients on chemotherapy and antiplatelets.

DISCUSSION

Treatment with Basal implants is simpler and quicker than conventional implant therapy since no augmentation procedures are involved[3]. The osseointegration of the implant demands that sufficient amount of bone be available for the proper and excellent prognosis of the treatment. However, the direct placement of an implant becomes a challenge when the available amount of vertical or conventional bone is below the required minimum value for successful osseointegration[9]. For this reason the conventional implants require extra procedures like sinus lift, distraction osteogenesis or use of bone grafts[10, 11]. Moreover, this increases the duration of the treatment and the patient has to stay edentulous throughout this period. The advent of basal implants into the field of implant dentistry has proved to be a boon for the patients who have atrophied ridges or even, were considered unfit to undertake implant treatment[12]. Conventional two-stage surgical implant techniques require two independent invasive surgeries separated by a 5-6 month healing period. In addition, an increased risk of trauma to the implant-bone interface may be caused by a removable transitional complete denture during the interim submerged period, which can compromise the implant success or increase conventional bone loss around the implants during initial bone healing[6] thus, making basal implants a better and more reliable option.

Literature suggests that steps taken for the restoration of partially or completelyed entulous maxilla and mandible with basal implants in an immediate load procedure showed reduction in costs and treatment time by about 50%[13] with a successful osseointegration of 98% when examined clinically and radiographically[14, 15]. Patients in whom the atrophied maxilla and mandible rarely offered any vertical bone for implant insertion; the bone available in the horizontal plane was utilized with the use of basal osseointegrated implants and was immediately loaded[16, 17]. Additional surgical procedures like bone augmentations, generally performed for conventional implants for stimulating bone growth in compromised bone has its own limitations like high costs, surgical risks and delayed time for loading thus, increasing the risk of implant failure[18, 19]. Alternative methods like zygomatic and basal implants should be considered as they require no bone augmentation procedures[20]. Patients who experience complete implant loss or graft failure pose a great challenge for rehabilitation due to poor quality and quantity of future implant bed. The alternatives of using calvarial or iliac bone grafts are considered but despite of their success rates, they involve unpredictable morbidity of donor and recipient sites[17]. 63 sets of computed tomographic images were selected and the bone density was measure in a sample consisting of 23 men and 40 women. the investigation showed that cortical density of the maxillary alveolar bone was between 810 to 940 Hounsfield units and of the basal cortical bone was 835- 1135 Hounsfield units. Cortical density of mandible was 810-1580 Hounsfield units at the alveolar bone level and 1320- 1560 Hounsfield units at the basal bone. Thus, the basal bone of both the maxilla and mandible had higher bone density in general and the direct relationship between implant success and a greater bone density favoured the use of basal osseointegrated implants especially in atrophic ridges where the cortical bone was almost lost[21].

The amount and distribution of pressure, stress and deformation energy of bone and basal implants was evaluated at two different stages of bone healing. The model geometry and material properties were obtained from CT scans of a human mandible. It was found that approximately 90% of the deformation energy was absorbed by the bone regardless of its healing state. The immediate basal implant distributed the peak forces to the basal cortical bone and also reduced the stress over the crestal bone[12]. Post operative complications like peri-implantitis were not found in basal implants as the disease stopped from reaching the basal cortical bone. The functional load of a basal implant is not transmitted along the vertical axis because it is the horizontal cortical bone that bears the masticatory loads. The basal implant design makes it easier as it is the horizontal segments that play an active role in osseintegration rather than the vertical shaft. Moreover, it gives therapeutic options for sterile loosening of the implant to make functional adjustments and alterations of restoration systems which are impossible in conventional implants.[4, 22]. Successful cases of immediate loading of fixed prosthesis with the help of basal implants for the rehabilitation of atrophic

maxilla and mandible for large edentulous spans have been recorded. Patients with generalised vertical and horizontal bone loss were given fixed prosthesis within 72 hours of surgery. The treatments were planned using a 3D computed imaging and basal implants were inserted to utilize the basal bone. These implants have been successfully utilized in the pterygopalatine regions[23], anterior maxilla and mandible[23, 24] and in for full mouth rehabilitations[25] where these implants anchored the cortical bone forming the roof and floor of the nose, wall of the maxillary sinus and base of the atrophic mandible. Post operative CBCT after 1 year revealed newely generated bone which had remodelled into functional bone with trabaculae oriented perpendicular to the bone- implant interface. There was no sign of soft tissue inflammation and these implants provided excellent primary stability along their vertical surface and hence, were well suited not only for immediate loading, but also for immediate placement within 72 hours of surgery without any bone augmentation procedures[23, 24, 25.]

Complications

Unfortunately, functional overload osteolysis is one of the complications of basal implants. Microcracks are repaired by the formation of secondary osteons, a process called remodelling[4]. As long as the bone substance is not torn away from the implant and the area is not superinfected, the loss of mineralization remains diffuse but usually reversible. Basal implants in this status have a good chance of getting reintegrated at a high degree of mineralization, if loads are reduced to an adequate amount[4]. Any infection usually spreads submucosally and usually presents as an abscess. In such cases, it is treated like any general submucosal abscess where a generous incision is made to open and drain the abscess under a suitable antibiotic coverage.

Limitations

Most of the literature available on basal implantology was not in English Language, so there was limited number of articles available for the review of literature. The availability of basal implants was found to be a limitation in itself. Considering the different sizes and types of basal implants which is available in single, double and triple disk designs; most of the studies were able to use only double disk implants in maxilla and single disk implants in mandible, depending on the available bone height and labio-lingual width of the basal bone.

CONCLUSION

Basal implants are a ray of hope for patients with atrophic ridges which can be rehabilitated without any extra surgical interventions like bone augmentations thus, reducing the time and cost of the treatment plan and also provide immediate loading which help the patients to gain confidence and socialize normally.

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