International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 9; Issue 05(D); May 2020; Page No.22293-22296
DOI: http://dx.doi.org/10.24327/ijcar.2020.22296.4391

Research Article

PARADIGM SHIFT IN IMPLANT DENTISTRY

Dr. Y. Satya Sai Sruthi[1], Dr. B. Lakshmana Rao[2], Dr. Satyanarayana S V Tammineedi[3], Dr. P.S.H.L. Parvathi[4] and Dr. V. Chakradhar[5]

[1]Postgraduate Student, Department of Prosthodontics, Lenora Institute of Dental Sciences
[2]Professor & Head, Department of Prosthodontics, Lenora Institute of Dental Sciences
[3]Reader, Department of Prosthodontics, Lenora Institute of dental Sciences
[4,5]Postgraduate Student, Department of Prosthodontics, Lenora Institute of Dental Sciences

A R T I C L E I N F O

Article History:
Received 4th February, 2020
Received in revised form 25th March, 2020
Accepted 23rd April, 2020
Published online 28th May, 2020

Key words:

Osseointegration, implant, Socket shield, osseo-densification, dynamic implant valve approach, liga-plants.

A B S T R A C T

In this modern era implants have out classed and out matched fixed and removable modalities of rehabilitating edentulousness. this has been chiefly due to advancements in material science, improved knowledge of the bone-implant interface dynamics and surgical techniques. these in turn have made possible predictable outcomes for this mode of treatment. However, there are still many issues that need to be addressed. For example, even while osseointegration has been the bedrock of implantology the ankylosed nature of the interface does present significant problems in certain clinical situations. Similarly, the nature of the bone and anatomic proximity of the sinus in the posterior maxilla does present issues while navigating this region. Last but not the least has been the not so successful methods to conserve bone loss during osteotomy for implant bed preparations which can compromise primary stability. this article is an attempt to highlight the various strategies adopted to overcome these hurdles and which have resulted in a paradigm shift in the way implantology will be practiced in the future. A paradigm shift means a fundamental change in approach or underlying assumptions.

INTRODUCTION

Implant anchored rehabilitation is the new norm for the management of edentulousness in any form. This has been the outcome of the synergistic efforts by both clinicians and engineers. Challenged by clinicians for improved materials, and designs for implant bodies biomedical engineers have responded wonderfully by providing them with better and improved materials and designs. The bedrock on which implantology rests is the phenomenon of osseointegration.a term coined by the pioneer Brånemark and defined by him. Later Albrektsson a close associate of Brånemark enunciated six parameters for successful implant therapy and they are 1.the implant material, 2. implant surface, 3. implant design, 4. host factors, 5. implant surgical technique and 6. biomechanical factors which play a leading role in achieving osseointegration.[1]Of the six, three he said are within the control of the profession. They are implant surface, implant design, and surgical technique. Through this paper we would like to review the recent advances in pertaining to the implant surface, design and surgical technique.

Paradigm Shift in Surgical Technique: Osseodensification

Primary Stability has been an important factor in assessment of success of an implant and it is influenced by the shape and design of the implant, quality and quantity of the bone, the surgical technique and skills of the surgeon, whilst its maintenance is depended on the loading conditions, the presence of par functional habits, and the healing capacity of the host.[2,3]

To increase the primary stability of an implant placed in low density bone procedures opted are:[3]

1. Omitting bone tapping,
2. Bi-cortical fixation,
3. Under-preparation,
4. Stepped osteotomy,
5. Condensation.

To overcome the disadvantages of these procedures the reinvented procedure is OSSEO-DENSIFICATION.[2,3] An optimized surgical protocol must satisfy two conditions: provide an implant bed that will help achieve primary stability and two, minimize bone to the maximum. While the first can be achieved relatively easily the second was proving to be an intractable problem. Today with the advent of the concept of osseodensification a solution to this last problem is also at hand.

Corresponding author:* **Dr. Y. Satya Sai Sruthi
Postgraduate Student, Department of Prosthodontics, Lenora Institute of Dental Sciences

Principle of osseodensification:[2,3,4]

In direct contradistinction to the conventional mode of osteotomy where the drill actively churns out bone by actively 'cutting "it, the osseodensification technique condenses the bone even while drilling it. This results in almost zero loss of bone. Even while providing primary stability. This condensation is achieved by using special burs called Versah burs. These have flutes which when turned counterclockwise at 800 to 1500 rpm condenses bone rather than cutting itand condenses the bone and compacts the autologous bone graft in the osteotomy site. Truly a paradigm shift in the way osteotomy is performed.

Rationale of Osseo-densification procedure[2,3,4]

1. This process is the densification of the bone that will be in immediate contact to the implant results in higher degrees of primary stability due to physical interlocking between the bone and the device,
2. faster new bone growth formation due to osteoblasts nucleating on instrumented bone that is in close proximity with the implant.

The bur technology was developed by Huwais S, when rotated in clockwise direction it has the cutting action on the bone, when in anti-clockwise direction it has non-cutting action and densifies the bone (FIG1). The osteotomy preparation has to be done by Bouncing-Pumping Motion (Fig 2).[4,5,6]

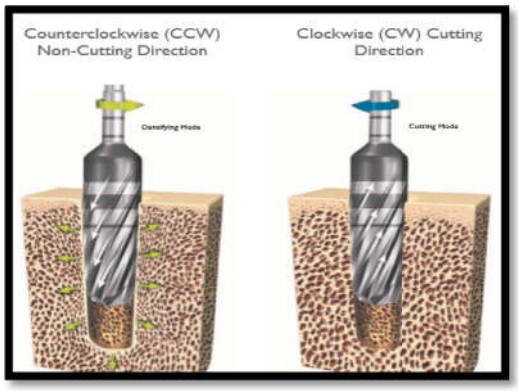

Fig 1 Bur technology: clockwise and anti-clockwise rotation

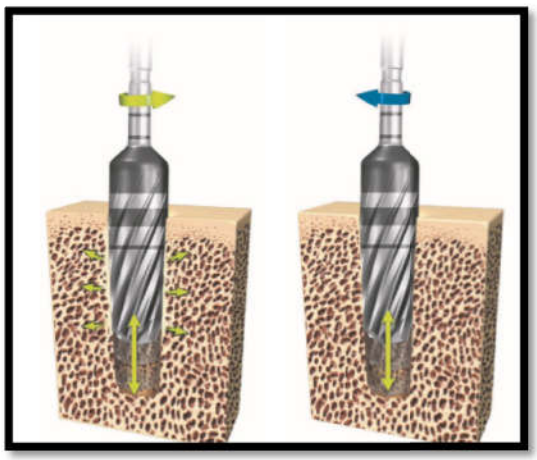

Fig 2 Bouncing and pumping motion

Indications:[2]

1. when bone quality is SOFT,
2. when width of available bone is LESS THAN 3MM (lateral ridge expansion),
3. when posterior maxillary height is LESS THAN 7MM (maxillary sinus elevation),
4. when density of bone is LOW.

Paradigm Shift in Implant Surface: Liga Plants[7,8,9,10]

Implant is expected to replace the missing natural tooth both in structure and function. The fixture of the implant replaces the root portion of the tooth only partly in both structure and function. The main difference between a natural tooth and implant is presence of periodontal ligament (PDL) in natural tooth which helps in vertical movement of the tooth and acts as shock absorber. Due to lack of PDL in the implant may lead to failures in the clinical scenarios like tooth and implant supported fixed restorations and even a single tooth replacement because of the difference present vertical movement there will be increased occlusal highpoint and interferences on the implant crown than on the natural tooth leading to crestal bone loss. To overcome such problems, Ligaplants were developed recreating the natural tooth anatomy. Liga plant by literal meaning it is implant with periodontal ligament (FIG 3).

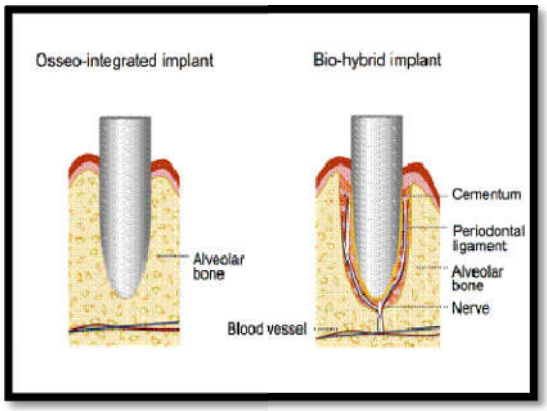

Fig 3 Osseo-integrated implant and Liga plant

Properties of Liga Plants:[7,8]

1. PDL cells distribute forces, elicited during masticatory function and other contact movements to the alveolar process via the alveolar bone proper.
2. It gives the tooth some movement in the socket by acting as a shock absorber.
3. Proprioception is also provided by Liga plants.
4. It also homes vital cells such as osteoblasts, osteoclasts, fibroblasts, cementoblasts, and most importantly undifferentiated stem cells which are osteoconductive in nature.

Procedure of Obtaining Ligaplants:[10]

1. Temperature responsive culture dishes preparation
2. Cell culture and cells
3. PDL cells culturing in a bioreactor

Temperature responsive culture dishes preparation: On-to polystyrene culture dishes, N-isopropylacrylamide monomer in 2-propanaol solution was spread. Then these dishes were subjected to electron beam irradiation with an Area Beam Electron Processing System. The dishes were then rinsed with cold water to remove ungrafted monomer and then sterilized with ethylene oxide.

Cell culture and cells: From an extracted tooth human periodontal ligament cells were isolated. From the middle third

of the root periodontal tissue was scraped with a scalpel blade after extraction. The harvested tissue was placed into culture dishes containing = Dulbecco's modified Eagle's minimal essential medium, supplemented with 10% fetal bovine serum and 100units/Ml of penicillin-streptomycin.Thenin a humidified atmosphere of 5% CO_2 at 37°C for 48 hours those outgrowth cells were cultured to allow attachment of the cells to the dishes. The debris were eliminated by washing the dishes and the medium has to be changed three times per week. Human periodontal ligament cells were placed on temperature-responsive culture dishes (35 mm in diameter) at a cell density of $1x10^5$ and cultured at 37°C supplemented with 50mg/mL ascorbic acid 2-phosphate,10nM dexamethasone and 10nM ßglycerophosphate that function as an osteo-differentiation medium to harvest the cell sheet.

3) PDL cells culturing in a bioreactor: A hydroxyapatite (HAP) coated titanium pin, was placed in a hollow plastic cylinder leaving a gap of 3mm around the pin. Through the gap culture medium was continuously pumped. Single cells suspension, obtained from human, was seeded first into plastic vessels under a flow of growth medium for 18 days.

ADVANTAGES[9,10]

- ✓ It can decrease problems faced by implants such as gingival recession and bone defects of the missing tooth site.
- ✓ It mimicsnatural tooth.
- ✓ It induces bone formation.
- ✓ Despite the initial fitting being loose in order to spare PDL cell cushion, Liga plants firmly integrates without interlocking and without direct bone contact.
- ✓ DISADVANTAGE:[9, 10]
- ✓ The main disadvantage with the Liga plants is primary stability cannot be assessed.

Paradigm Shift in Implant Design: Diva Implant[11]

When patients present with advanced ridge resorption, it could complicate the procedure of implant surgery. This problem is magnified in the posterior maxilla where ridge resorption and sinus pneumatization, compounded with a poor quality of bone, are often encountered. The procedure of choice to restore this anatomic deficiency is maxillary sinus floor elevation.

There are many procedures available in the literature on sinus lift. Some of them are:[11]

1. Transcrestal Approach (tSFE)
2. Lateral Window Approach (LatW)
3. Piezoelectric Surgery (PS)
4. Balloon elevation technique
5. Hydraulic Sinus Lift Technique (HySiLift)
6. Osteotome Technique (OstSFE)
7. Nasal suction technique

Most of the sinus lift procedures performed by the surgeons are cumbersome and carried the high risk of possible complications including infection, bleeding, etc., DIVA, a new sinus elevation technology, delivers an innovative solution of restoration that enables sinus lift implants to be carried our using a simple, relatively short procedure, with significantly lower risk of complications and patient discomfort.

Diva Implant:[12,13,14]

The Titanium-Aluminum-Vanadium implant (Ti-6Al4V ELI) has an internal sealing screw that serve for endoscopic direct observation and as a drug delivery system via its channel.

Unique Qualities of Diva:[11]

- ✓ Use of implant itself to elevate the sinus membrane without risk of perforation
- ✓ Its configuration allowing injection of bone substitute directly through the implant
- ✓ Absolute sealing of the implant against oral flora

Fig 4 DIVA implant

Fig 5 Initial and final valve screws of DIVA implant

Diva Implant Kit:[11]

a. DIVA Implant (FIG 4)
b. Internal Screw Driver (optional)
c. Syringe
d. IV Cannula
e. Synthetic Bone Paste (TCP in hyaluronic acid)
f. DIVA osteotome

Step by Step Procedure:[11, 12, 13, 14]

Step by step procedure of the DIVA implant placement is explained in the figure 6

1. Initial drill
2. Use of osteotome
3. Insertion of diva implant
4. Long screw valve removal (FIG 5)
5. Attach saline syringe cannula
6. Racheting by 1mm
7. Attachment of bone graft material syringe
8. Placement of second screw valve (FIG 5)

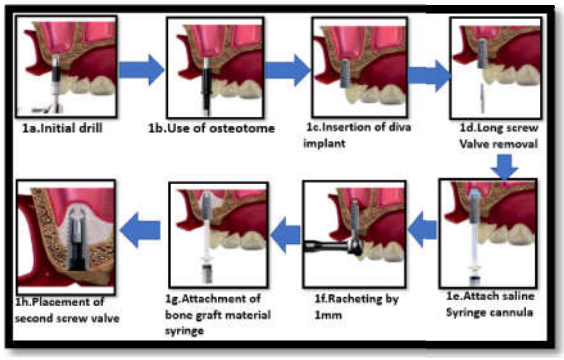

Fig 6 Step by step procedure of DIVA implant placement

The New Approach Permits[11]

- a closed sinus lifting procedure via the implant itself,
- drug delivery via the implant port,
- intraosseous feedback via the same port,
- augmentation procedures via the implant, and
- endoscopic control over the implant and the surrounding bone during the entire period of the usage of the implant,

CONCLUSION

The world wide acceptance of implant-based rehabilitation for edentulousness is chiefly due to the predictable outcome it offers. However, there still remains many unaddressed issues.one such being the placement to restoration time lag. Yet another has been the presence of an ankylosed bone-implant interface rather than a natural suspensory natured interface. Yet another issue has been the often difficult and complicated techniques to manage the posterior maxilla where anatomic conditions like a lowered maxillary sinus can and does pose difficulties. The worldwide demand of the Implants, has opened up the scope of the advancements. Current research and observations evoked a change of paradigm during the past decade: instead of focusing mainly on topographical features, surface roughness, the new paradigm includes now the change in the technique used, type of implants being used with topographical modifications. New technologies, based on the three-dimensional evaluation of patients for dental implants have opened new avenues to clinicians for accurate and predictable diagnosis, planning, and treatment in a multidisciplinary patient-based approach. The clinicians have to thoroughly check for select material and choose particular technique accordingly.

References

1. Albrektsson T, Brånemark PI, Hansson HA, Lindström J. Osseo integrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand 1981; 52:155-70.
2. Huwais S, Meyer E. Osseo densification: A novel approach in implant osteotomy preparation to increase primary stability, bone mineral density and bone to implant contact. Int J Oral Maxillofac Implants 2016; 32:27-36.
3. Meyer EG, Huwais S. Osseo densification is a Novel Implant Preparation Technique that Increases Implant Primary Stability by Compaction and Auto-Grafting Bone. San Francisco, CA: American Academy of Period ontology; 2014.
4. Huwais S. Inventor; Fluted osteotome and surgical method for use. US Patent Application US2013/0004918; 3 January, 2013.
5. Huwais S. Autografting Osteotome. WO2014/077920. Geneva, Switzerland: World Intellectual Property Organization Publication; 2014.
6. Huwais S. Enhancing implant stability with osseodensification: A two year follow up. Implant Pract 2015; 8:28-34.
7. Bharathi D, Siji JT, Srinivasan, Senthil KS. Ligaplants-A review. Annals of dental speciality 2017; 5(2): 71-3.
8. Nair ST, Sreedevi KG, Beevi R, Janam P. Ligaplants- a therapeutic modality on the horizon. JSPIK 2015; 8(3): 101-4.
9. Arunachalam LT, Sudhakar U, Merugu S, Janarthanan AS. Tissue-engineered periodontal ligament on implants : Hype or hope ? J Dent Implant 2012;2: 115-6.
10. Jibi J, Rao BL, Sruthi YSS, Pratyusha T, Chitra C. A Novel Approach in Implant Dentistry – LIGAPLANTS. Int J Sci Res (IJSR). 2019;8(3): 43-5.
11. Sruthi YSS, Rao BL, Jibi J, Pallavi C. Neoteric sinus elevation: a smart lift - DIVA implants. Paripex Ind J Res. 2019; 8(3): 1-3.
12. Nahlieli O, Casap N, Moshonov J, Zagury A, Michali E, Samuni Y. A novel dental implant system with an internal port for endoscopic closed sinus augmentation: a feasibility study in pigs. Int J Oral Maxillofac Implants 2013; 28(6): 556-561.
13. Nahlieli O. Dynamic implant valve approach for dental implant procedures. Chine J Dent Res 2014; 17(1): 15-21.
14. Nahlieli O, Zagury A, Michaeli E, Bruck N, Nahlieli DD, Casap N. Four- years' experience with dynamic implants with internal port for minimally invasive sinus elevation. Quintessence Int 2016; 47(8): 669-675.

How to cite this article:

Dr. Y. Satya Sai Sruthi *et al* (2020) 'Paradigm Shift in Implant Dentistry', *International Journal of Current Advanced Research,* 09(05), pp. 22293-22296. DOI: http://dx.doi.org/10.24327/ijcar.2020. 22296.4391

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