Review Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2018;7:2:34-42.

Variegated Dental Implant Abutments: A Review

Prakash Nidawani[1*] Chandan Sengupta[2] Harsha R. H[3] Bhargavi Sadineni[4]

[1]Professor, Department of Prosthodontics, Navodaya Dental College, Raichur, Karnataka, India.
[2]Post Graduate Student, Department of Prosthodontics, Navodaya Dental College, Raichur, Karnataka, India.
[3]Professor, Department of Prosthodontics, Navodaya Dental College, Raichur, Karnataka, India.
[4]Post Graduate Student, Department of Prosthodontics, Navodaya Dental College, Raichur, Karnataka, India.

ABSTRACT

Background: Dental implant treatment modality is one of the most successful option for various types of prosthetic rehabilitative situations due to their reliable osseo-integration. Modifications in the implant abutment, fixture and technique has augmented the success rate of treatment with implants as well. Over the last 30 years, clinical studies with osseointegrated implants have shown excellent long term results, with over 90% success rate. Present day implant dentistry is almost a routine practice. Implants need to be placed at various angulations since every situation presents with a peculiar oral anatomy, bone texture, ridge contour, arch form and vital structures. Therefore, the clinician should be updated regularly regarding availability of different abutments to achieve optimal occlusion and masticatory efficiency. Wide ranges of abutment designs and materials are available to achieve this goal.

This review on different implant abutment design and materials strives hard to summarize the evolution of abutments and enables the clinician to understand the different implant abutments available so as to meet specific clinical situation and to achieve greater success with implant treatment modality.

Keywords: Dental Implant, Abutments.

INTRODUCTION

The concept of osseointegration , implant therapy are rapidly evolving as highly predictable and successful treatment approaches in edentulous, partially edentulous and single tooth restorations. The implant design and surface condition influences the dynamics of osseointegration. The development of implant surfaces, surgical protocols and the esthetic components of prosthesis have helped the prosthodontists to aid in planning, restoring the missing dentition.[1] The advances in metallurgy led to the evolution of several abutment designs to meet the esthetic and functional requirement.[2] The abutment provides the retention, support,,stability and optimal position for the final restorations. The abutments can usually be separated from the implant, but in some cases they may form part of implant itself but not all implant restorations require abutments. The association of abutment to the implant can either be a three tier or two tier system. A three tier system involves three separate components –the implant, the abutment, and the crown where as a two tier system incorporates only implant and a single unit of abutment and crown. [3,4] The crown onto the abutment or implant platform . There are also current implant systems that enable the abutment to be locked or friction fit into the implant, without a screw or cement method of retention.[5-9]

The availability of immense number of prosthetic components left many dental professionals confused at the selection process of these components and in particular the indications for the use of such components.[10,11] So, this article aims to

Received: Dec. 5, 2017: **Accepted:** Jan. 29, 2017
***Correspondence Dr. Prakash Nidawani.**
Department of Prosthodontics, Navodaya Dental College, Raichur, Karnataka, India.
Email: Not Disclosed

pISSN 2278-0076
eISSN 2321-9270

summarize the evolution of abutments and enables the clinician to understand the different implant abutments available so as to meet specific clinical situation.

Fig 1: Dental Implant Abutments.

Background

Since the begining of mankind, humans have used dental implants in one or another form to replace missing teeth. In approximately 2500BC, the ancient Egyptians tried to stabilize teeth that were periodontally involved with the use of ligature wire of gold. Around 300AD, innovative peoples used carved out ivory which were then stabilized by gold wire to create a fixed bridge. The first evidence of dental implants is attributed to Mayan population. Around 600 AD using shells as implants as a replacement for mandibular teeth . around 800 AD a stone implant was first prepared and placed in the mandible in the early Honduran culture.[12] From the 1500's to about 1800's, teeth in Europe were collected from the underprivileged or from cadvers for the use of allotransplantation. During this period Dr Hunter Suggested transplanting teeth from one human to another; his experiment involved the implantation of an incompletely developed tooth into the comb of rooster and observed an extraordinary and astonishing event:the tooth became firmly embedded in the comb of rooster and the blood vessels of the rooster grew straight into the pulp of the tooth.[13,14] In 1809, j.maggiolo inserted a gold implant tube into a fresh extracted site and observed there was extensive inflammation of the gingiva. [15] In 1913, Dr.EJ Greenfield placed a 24 guage hollow latticed cylinder of iridio-platinum soldered with 24-karat gold as an artificial root to fit exactly the circular incision made for it in jaw bone of the patient.[16] In 1930's two brothers Drs Alvin and moses strock, experimented with orthopaedic screw fixtures made of vitallium (chromium-cobalt alloy) they observed it provided anchorage and support for replacement of missing tooth. They were acknowledged for their work in selecting a biocompatible metal to be used in human dentition.[17] The strock brothers were also thought to be the first to place the first successful endosteal implant. In 1938,Dr.P.B. Adams patented a cylindrical endosseos implant that was threaded both internally and externally and had smooth gingival collar and a healing cap.[18] A post-type endosseous implant was developed by formiggini("Father of Modern Implantology") and Zepponi in 1940's. The spiral stainless steel design of the implant allowed bone to grow into metal.

Implant discoveries continues….The fabulous forties and fantastic fifties

Dr Raphael Chercheve added to spiral design by creating burs to ease of insertion of implant for a best fit. Dahl developed subperiosteal implant in 1940's and his work was carried out by Gershkoff and Goldberg produced a cobalt-chromium-molbdenum implant with extension of dahls design to include external oblique ridge.[20] In 1950's Dr Bodine observed several patients in armed forces; the framework design seemed to be more streamlined now and found that fewer struts and girders were needed. The holes for the screws were located in areas where the bone had the greatest strength and thickness.[21]

Increase of implant innovation:1960-1970's:

Various implant designs expanded in 1960's. Dr Chercheive crafted a double helical spiral implant made of cobalt and chromium.[22] The basic spiral design was turned into flat plate by Dr Leonard Linkow in 1963.[22,23] In 1970's Roberts and Roberts began the development of Ramus Blade endosseous implant made up of surgical grade stainless steel to serve as a "synthetic:c third molar".[24] The 1970's brought placement of vitreous carbon implants by Grenoble.[25]

Beginning in middle of 1980's the customary implant used by many dental clinicians was endosseous root form implant. Dr Tatum introduced the omni R implant in 1980's made up of titanium alloy. The ITI Company in 1985 by the Straumann Company has exclusive plasma sprayed

cylinders and screws which are designed to be placed in one stage operation.[27] The most recent dental implant innovations involve the use fluoride, antibiotics and growth factors .

CLASSIFICATION:

Based on type of retention

1. Abutment for screw retention
2. Abutment for cement retention
3. Abutment for attachment

Based upon angulation

1. Straight abutment
2. Angled abutment

Based upon design

1. Flat topped abutment
2. Tapered shouldered abutment

Based on the commercial availability

1. Steri oss abutment
2. Paragon abutment
3. Ceradapt abutment
4. Octa abutment
5. UCLA abutment

Dental implants aid in replacing a single tooth, several teeth or even all of the teeth. An abutment is used as an extension to complete the foundation for the new tooth to be attached. The bone is better preserved with implant supported bridges as it replaces some of tooth roots that had deteriorated.

CEMENT VS SCREW RETAINED ABUTMENTS

The decision of how to retain an implant restoration is a choice of debate. In the earlier years of dental, screw retained implants were the default approach. However, with further practice it suddenly became that people were almost exclusively using cement retained implants. Today, it appears that we have come full circle back to using primarily screw retained as we continue to learn about the implant failures due to the cement left behind. When deciding between screw retained and cement retained implants, it is important to remember there are benefits and liabilities to using each method, often related to location of the implant.

Esthetics tend to be the biggest obstacle, especially in anterior cases. With screw retained implants the screw emergence has to be placed in such a position that it wont compromise the overall esthetic of the case. For this reason, when restoring anterior, cement retained tends to be the better option as it eliminates the screw retained access holes.

Shetty S et al in 2014 Done a review on the principles of screw retained and cement retained fixed implant prosthesis. They concluded that retention system that is more functional and stable in the successful management of future failures and complications should be selected based on individual patient situation since both screw and cement retained have their advantages and disadvantages. And also due to increased technical and prosthetic complications associated with screw retained prosthesis, cement retained restorations are preffered in patients with parafunctional habits.[28]

Wittenben JG in 2014 did a review to assess the survival outcomes and reported complications of screw and cement retained fixed prosthesis supported on dental implants. Although the result suggested no stastical difference between screw and cement retained for the failure rates, screw retained exhibited a fewer technical and biologic complications overall.[29]

CEMENT RETAINED ABUTMENTS

INDICATIONS:

- In replacing missing teeth in single or multiple unit applications with in the mandible or maxilla
- Immediate placement in extraction sites and partially or completely healed alveolar ridge situations
- For use in soft bone applications where implants with other implant surface treatments may be less effective

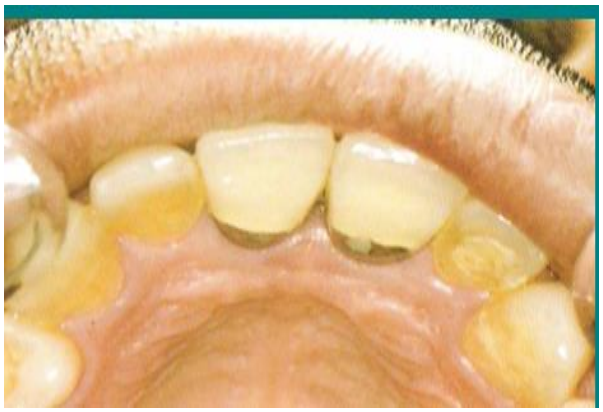

Fig 2: Cement Retained Abutment.

ADVANTAGES:

- Better passivity
- Easier to obtain esthetics
- Less fatigue

DISADVANTAGES:

- Difficult to retrieve unless soft cements are used
- Gingival retraction maybe needed
- When permanent cements are used evaluation and maintainance may sometimes be difficult.

TYPES OF ABUTMENT FOR CEMENT RETENTION:

1. Single unit or one piece abutment- Does not engage anti rotational hex but fits flush with the implant platform

2. Two piece abutment-has one component to engage anti rotational hex of implant body and the other component to fixate the abutment and implant body together

SCREW RETAINED ABUTMENTS

Fig 3: Screw Retained Abutments.

INDICATIONS

- Replacement of single or multiple missing teeth
- For complete edentulous treatment
- In cases where re-attachment of crown for maintainance purpose is required

ADVANTAGES

- Less momentum of force
- No risk of cement in the sulcus
- Easily retrievable

DISADVANTAGES

- Loosening of screws
- Difficulty to obtain passivity
- Difficult to obtain esthetics
- Greater chances of porcelain fracture

STRAIGHT VS ANGLED ABUTMENTS

A straight abutment is usually parallel to the long axis of the implant. There are some implant abutments which are placed at an angle to the long axis of implants known to be angled abutments. However, increased stresses on implants and have been associated with angled abutments. The authors stressed the dental literature for clinical trails that appraised the survival rate and complications (biologic and technical) associated with prostheses that are supported by angled abutments. The results of photoelastic stress assessments, finite element analysis and straight-gauge studies indicated that increased abutment angulations result in the placement of greater amount of stress on prostheses and the surrounding bone than that associated with straight abutments.[30-36]

STRAIGHT ABUTMENT

Fig 4: Straight Abutment.

INDICATIONS

- For replacing single tooth for large prosthesis upto full arch
- Used only when emergence profile are parallel
- Indicated for replacing single tooth for large prosthesis upto full arch, implant borne reconstructions

ADVANTAGES

- Allows more precise and accurate insertion of abutments
- Versatile
- Simple and easy to use

DISADVANTAGES

- Inadequate alveolar ridges (height and width)
- Locations proximal to anatomical structures
- Stress distribution

ANGLED ABUTMENT

Fig 5: Angled Abutment

INDICATIONS

- In cases where anatomic limitations that does not allow axial placement of implants
- In presence of bony undercuts
- In cases where the ridge is closer to mandibular canal or paranasal sinuses

ADVANTAGES

- Reduces the stress transfer to the bone
- In all the cases of inadequate ridge , height ,width.
- Survival rate than straight abutments

DISADVANTAGES

- Requires surgical corrections such as bone augmentation, sinus elevation
- Occasionally involves nerve repositioning
- Technical problems associated with loosening

Available in angulations from 10-30 degrees

- Improved esthetics
- Increase in angle causes increase risk of fracture

COMMERCIALLY AVAILABLE IMPLANTS

- **STERI OSS ABUTMENT:**

Contains the compatible components for the discontinued implants from steri-oss, including the original non-hex, flat-top, the 3.25SD Hex-Loc and the replace was acquired byNoble Biocare of Zurich, Switzerland in 1999. [37]

Fig 6: Steri Oss Abutment

ADVANTAGES

- Prosthodontic acceptability good

- Moderate cost
- Easy to educate patient

- **PARAGON ABUTMENT:**

The complete paragon (core-vent) system was developed by Dr Gerald A niznick. Today,the paragon implant company,a subsidiary of sulzer medica,produces a variety of implants such as the original (core-vent CV,Screw vent SV,Biovent BV, Micro vent MV,and the taper-lock.)[38]

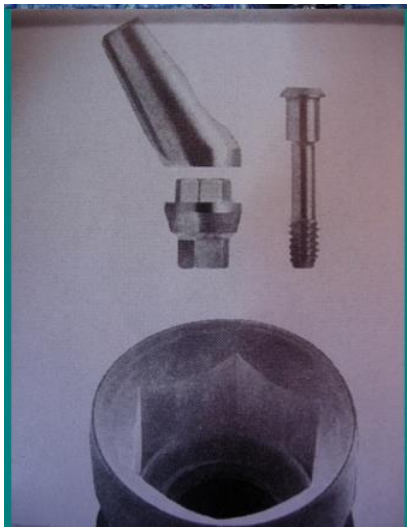

Fig 7: Paragon Abutment

- **CERADAPT ABUTMENT**:

(Wohlwend innovative) Contains aluminium oxide & yetrium stabilized zirconium oxide

All ceramic alternative to metal abutments

Pre machined precision milled abutment made to fit the implant hex
-Pore free strong wear rssesistant stable bio ceramic material

Fig 8: Ceradapt Abutment

- **OCTA ABUTMENT**:

The synOcta concept was introduced world wide in 1999 with the addition of an octagon to the morse taper section of the abutment and the implant. This is were the name synOcta comes from,"the synergy of two octas".[39]

Fig 9: Octa Abutment

INDICATIONS

- used in esthetically sensitive maxillary anterior region

ADVANTAGES

- Reliable
- Simple
- Flexible

- Used in esthetically sensitive maxillary anterior region
-Pre fabricated gold caps are available for attachment to removable super structures

-Internal octagonal design-resistance against crown rotations

- **UCLA ABUTMENT:**

This abutment is attached directly to the implant. It provides a pattern for the creation of screw retained veneered crown. It is available in traditional plastic configurations, gold alloy, gold base with plastic sleeve, and in a titanium version for provisional restorations

Fig 10: UCLA Abutment

ADVANTAGES

- Precision machined
- Titanium prosthetic screw included with all abutments
- Optional gold prosthetic screw
- Narrow chimney
- Waxing screw included with gold abutments.
- Improved Esthetics
- gold alloy abutment screw retention increases the pre loading forces
- abutment can be re angulated
- improved emergence profile

INDICATIONS

- single and multipletooth restorations
- Retreiving the screw retained restoration

CONCLUSION

Dental implant treatment modality is a promising treatment modality involving many components, of which abutments are very important. Since there are different abutments available fordifferent clinical situations, it is inevitable for the clinician to be upgraded regularly, regarding the availability as well as advances in different abutments as new ones are manufactured in the market. Hence, if abutment selection is improper the treatment outcome may be jeopardized. Conversely proper abutment selection along with proper treatment plan ensures successful treatment outcome.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Giglio,G.D., Abutment selection in implant supported fixed prosthodontics. Int J Periodontics Restorative Dent, 1999. 19(3): p.233-41.

2. Sadaqah n, Wahadni A A, Alhija EB. Implant abutment types: A Literature review-part 1. The journal of implant and advanced clinical dentistry.2010;2(3):93-8.

3. Karunagaran S, Wicks R,Paprocki GJ, Markose S. A Review of implant abutments-abutment classification to aid prosthetic selection . Journal of the Tennessee dental association.

4. Gracis,s.,et.al.,Internal vs. external connections for abutments /reconstructions: a systematic review. Clin oral implants res,2012.23 suppl6: p.202-16.

5. Shadid R, Sadaqa N, A Comparision between screw vs. cement retained implant prosthesis. A literature review . J Oral Implantol.2010 nov 23 [Epub ahead of print].

6. Prisco R, Morgano SM, D' Amato S. New Abutment for a screw-retained, implant-supported crown. J Prosthet Dent. 2001;85(1):30-33.

7. Buser D, Mericske-Stern R, Bernard JP, et al. Long- term evaluation of non-submerged ITI implants. Part I: 8-year life table analysis of a prospective multicenter study with 2359 implants. Clinical Oral Implants Research. 1997;8(3);161-172.

8. Jung RE, Pjetursson BE, Glauser R, et al. A Systematic review of the 5- year survival and complication rates of implant-supported single

crowns. Clin Oral Implants Res. 2008;19(2) 119-130.

9. Misch,C.E., Screw-retained versus cement – retained supported prosthesis. Pract periodontics Aesthet Dent,1995.7(9):p. 15-8.

10. Phillip G Kotick,B.B.,Abutment Selection for implant restorations. Inside dentistry, July 2011. 7(7).

11. Creugers NH, Kreulen CM, Snoek PA, de Kanter RJ. A systematic review of single tooth restorations supported by implants. J Dent 2000;28:209-17.

12. Ring Malvin E, editor. 2nd ed. Abradale Press; 1985. Dentistry: an illustrated history.

13. Abraham CM. a brief historical perspective on dental implants,their surface coatings and treatments. The open dentistry journal.2014;8:50-5.

14. Asbell Milton B. Dentistry. A historical perspective: being a historical account of the history of dentistry from ancient times. With emphasis upon the united states from the colonial to the present period. Bryn Mawr PaDorrance & co. 1988: 1-256.

15. Maggiolo Maneul de 1' art dentaire[Manuel of dental art]. Nancy France C.Le seure. 1809.

16. Greenfield EJ.Implantation of artificial crown and bridge abutments. Int J Oral implant. 1991; 7(2):63-8.[Pub Med]

17. Linkow LI, Dorfman JD. Implantalogy in dentistry: A brief historical perspective. N Y State Dent J. 1991;57(6):31-5.[Pub MED]

18. Burch RHDr. Pinkey Adams-a dentist before his time. Ark Dent. 1997;68(3):14-5.[Pub Med]

19. Linkow LI, Dorfman JD. Implantalogy in dentistry: A brief historical perspective. N Y State Dent J. 1991;57(6):31-5.[Pub MED]

20. Goldberg NI, Gershkoff A. The implant lower denture. Dent Dig. 1949;55(11):490-4.[Pub Med]

21. Bodine RL. Experimental subperiosteal dental implants. U.S. Armed Forces Med J. 1953;4:441-51.[Pub Med]

22. Cherchieve R.Considerazioni fisiologiche e pratiche su una osservazione originale di un impianto endosseo. Inform Dent. 1959;24:677-80.

23. Linkow LI. Intraosseous implants utilized as fixed bridge abutments. J Oral implant transplant surg. 1964:10:17-23. The radiographic role in endosseousimplant interventions. Chron Omaha District Dent SOC. 1966;29:304-11.[Pub MED]

24. Linkow LI, Dorfman JD. Implantalogy in dentistry: A brief historical perspective. N Y State Dent J. 1991;57(6):31-5.[Pub MED]

25. Markle DH, Grenoble DE, Melrose RJ. Histologic evaluation of vitreous carbon endosteal implants in dogs. Biomater Med Dev Artif Organs. 1975;3(1):97-114.[Pub MED]

26. Tatum OH, Hardin J. The omni implant system in Clarke's clinical dentistry vol 5 philadelphia. Pa JB Lippincott. 1984

27. Straumann USA LLC Available from :http://www.straumann.us/ 2014.

28. Shetty s, Garg A, Shenoy KK. Principles of screw retained and cement retained fixed implants prosthesis: A critical review. Journal of interdisciplinary Dentistry 2014;4(3):123-9.

29. Wittenben JG, Millen C ,Bragger U. Clinical performance of screw versus cement retained fixed implants supported reconstruction-A Systematic Review. Int J Oral Maxillofac Implants 2014:29(suppl):84-98.

30. Cavalla Ro J, Greenstein G. Angled implant abutments: a practical application of available knowledge. J Am Dent assoc. 2011:142(2):150-8.

31. Hsu ML,Chung TF,Kao HC. Clinical applications of angled abutments-A literature review chin dent J 2005:24(1):15-20.

32. Atieh RM. Fatigue testing of straight and angled abutments in a high torque dental implant system 2014(thesis copy)

33. Eger DE, Gunsolly JC , Feldman S. Comparison of angled and standard abutments and their effect on clinical outcomes- a preliminary report.(int j oral maxillofac implants 2000;15:819-23.

34. Guven S et al. comparison of the effects of different loading locations on stresses transferred to straight and angled implant supported zirconia frame works; a finite element method study. Journal of biotechnology and biotechnological equipments.2015;29(4):766-72.

35. Las Casas EB, Ferriera PC, Cimini CAJR, Tolledo EM, Bara LP, Cruz M. Comparitive finite element stress analysis of straight and angled wedge-shaped implant designs. Int J Oral Maxillo Fac Implants 2008:23:215-25.

36. Koca OL, Eskitascioglu G, Usumez A. Three dimensional finite element analysis of functional stresses in different bone locations produced by implants placed in the maxillary posterior region of the sinus floor. J Prosthet Dent 2005;93:38-44.