Review Article

Implant Abutments – A Review

Abraham MH, Philip MJ, Venkatakrishnan JC, Pradeep R, Narasimman M, Pandian R

Abstract: With an increase in the availability of implant restorative components, the selection of an appropriate implant abutment for a given clinical situation has become more challenging. This article describes various abutment systems that will help the practitioner understand the different implant abutments available and therefore be able to understand the selection of abutments for single and multiple unit fixed implant prosthesis.

Key words: Abutments; Dental; Esthetic; Implant; Prosthesis; Restoration.

INTRODUCTION

An abutment is that part of an implant which resembles a prepared tooth and is designed to be screwed into the implant body. It is the primary component which provides retention to the prosthesis. The parts of an abutment include, the base, which fits into the internal core of the implant, the head, which protrudes and serves as the prosthetic retainer and the collar that is placed at pergingival level and connects the base and the head. Abutment may be of the one piece or the two piece type. The various types of abutments are: standard abutment, estheticone abutment, angulated abutment, ceraone abutment and overdenture abutment.

Standard abutments

These are cylindrical in shape and are available in various heights with corresponding Ti abutment screws. The base is hexagonal in shape and fits into the implant fixture. They are used for fabrication of edentulous fixed bone anchored bridges. The abutment restoration junction is placed 2mm above the oral mucosa to aid in oral hygiene.

Two impression techniques exist.[1] One uses a tapered impression coping in which, the coping is screwed into the internal screw channel of the abutment and the impression made without removing the coping. The coping is then removed, connected to an analog, inserted into the impression and the cast is poured. The other, uses a square impression coping that contains undercuts which gets locked within the impression. The guide pins are unscrewed and removed from the impression. The latter is a more accurate technique.

The base of the impression coping is round. An anti rotation feature is not necessary for multiple implant restorations. A gold alloy cylinder that fits on top of the standard abutment becomes a part of the final restoration after casting. Gold screws connect the gold cylinder to the abutment. The final restoration is held in place by these gold screws tightened to 10 Ncm[2].

Esthticone abutments

These are made of pure Ti with a hexagonal base and are tapered. The three sizes (one, two and three) correspond to the height of the collar[3] in millimeters. They are used for esthetic restorations, multiple implant screw retained restorations, ceramo-metal and cast metal restorations. The restorations are placed 2-3 mm subgingivally and gives a natural look. The technique for its use is similar to that described for standard abutments.

Angulated abutments

These incorporate a thirty degree or seventeen degree angulation[4] in their design. They are used to overcome problems associated with implant angulation. The base contains a twelve-sided configuration. They are indicated for multiple implant restorations.

Ceraone abutment

These are pure Titanium abutments for cement-retained, single-tooth restorations.[5] Various collar heights ranging between 1 mm and 5 mm are available. They have a hexagonal base and are connected to the implant by a gold alloy abutment screw with 32 Ncm of force. Plastic impression copings fit by frictional resistance to the abutment and are retrieved with the impression. The analog is placed and the cast poured.

Healing caps are placed to maintain soft tissue support. Porcelain is applied to ceramic caps to fabricate all-ceramic single tooth restorations. Temporary or permanent cementation is performed. It is critical to remove excess cement.

Overdenture abutment

Abutments for over denture ball attachments are similar to the standard abutment. The male component is a ball head of the abutment screw and the female component is a plastic cap within denture base. The plastic cap uses rubber o-rings that fit over the abutment screw and provides retention[6]. Laboratory analogs are available, giving the option of incorporating the attachments in the clinical or in the laboratory. It is simple and time saving.

Abutment Types for Single Tooth Restorations

1. Standard abutments: These are premade abutments made of Titanium. They consist of two pieces, the abutment and the abutment screw. A variety of heights are available with smooth collars extending from the implant head to the crown margin. Nobel biocare implant - Ceraone, fits a flat top and engages a raised hexagon to give an anti rotation element for the abutment[7]. The abutment is retained by the implant head using a gold screw. A conical headed (Astratech,Frialit,Straumann) abutment has a matched conical fit surface along with an anti rotational element. The coronal part of a single tooth abutment, needs adequate retention and resistance for the crown to be retained by cement to the abutment. Other designs (Astratech -single tooth) have a space between the abutment and the crown to allow for cement release. Although their margins do not follow the gingival contour and they are not suitable for labially placed cases, these abutments are simple to use, require, minimal chairside time and offer predictable retention and fit of the crown.

2. Prep able abutments: The retentive element for the crown is a block of metal customized to an ideal preparation. The abutment is prepared using a high speed drill extraorally.[8] The gingival margin follows the gingival contour and is placed subgingivally on the labial aspect and supragingivally on the proximal and palatal aspects. The metal surface that contacts the crown, is left coarse for retention and those that contact the tissue is smoothened. They can be prepared in two ways. One is by producing the abutment and the final crown in one stage. This is used when soft tissue is healthy. A good marginal fit is possible although there is a risk of poor long term retention. The other is by preparing the abutment and provisional crown in the first stage, followed by making the impression with the abutment in place and the final crown, in the second stage. This method offers a more predictable result although the impression is difficult to make. It is useful if the emergence and the profile of the soft tissue needs to be modified. This technique suits every situation, copes with angulation changes and allows soft tissue remodelling and a good emergence profile. The disadvantages of this technique is that it requires a more complex laboratory technique, second intraoral impressions and offers a less predictable fit of abutment to the crown.

3. Fully customized abutments: These are useful in cases of compromised implant positioning. The implant head impression is made and the abutment placed in position on the model. The abutment shape is waxed onto the pattern and then cast[9] in precious metal. It is possible to move the long axis of final restoration.

4. Computer generated abutments: Using computer software, an ideal abutment shape can be generated and viewed in 3 dimensions[10]. The implant head impression is made and the working model is placed in a scanner. Readings of implant position and angulation are noted. The position of the gingival margin can be superimposed on the image and sent to a centre where the abutment is made in Titanium.

5. Ceramic abutments: They are made of dense porcelain. And enjoy a good success rate. They are highly aesthetic[11]. The final crown should be fabricated in all-ceramic & cemented with a tooth coloured luting agent. They are not suitable where significant angulation changes are needed.

6. Abutments for screw retained crown: Abutments designed for bridges are used eg. Estheticone-Nobelbiocare, Octa-Straumann. It is necessary to use gold cylinder that has an internal facet that engages the abutment.

7.Abutments for cement retained crown: One piece abutments do not engage anti rotational features on the implant body. They are used for multiple splinted implants. The advantages of these abutments include, that no torque wrench is needed, they are stronger, no screw loosening occurs, they are less expensive and it is easy to achieve complete seating. The disadvantages include that they can be used only for multiple abutments and cannot be used for angled abutments.

Two piece abutments engage anti rotation features on implant body and the abutment screw fixates the abutment and the implant body. They are used for single tooth implants, in indirect technique for prosthesis fabrication and in angled abutment situations. They provide anti-rotational resistance under shear forces, although screw loosening can occur and torque and counter torque devices are needed.[12]

Abutment Designs

These include, threaded (straight, prefabricated angled, custom), frictional (press fit, cold welded)[13] and non-threaded (cementable)

I. **Threaded Abutment**

a. Straight : Used when axial inclination and parallelism of implants are favourable. Some contain collars (eg. Integral). Some systems require separate trans epithelial collars (eg. Nobelpharma, IMZ). Calcitek, hexlock and Sterioss abutments have an anti rotation design.

b. Pre-fabricated angled: These are not available from all manufacturers. Implant systems that supply them are Integral, Steri-oss, Sustain. Implant innovations supplies 15-30 degree angled, one piece, collared abutments. Steri-oss supplies it in 2 parts, a hexagonal vertical component and a 15-25 degree angled post.

c. *Custom abutments (angled & straight):* They are made by making impressions or by direct resin patterns. Impressions of internal threading of implants are made with a special transfer post. Impressions are removed, analog attached and cast poured. Angulations, those greater than 25 degree cause excessive force.

II. Frictional / Press fit

Stryker & Miter blades, supplies this abutment. Straight and angulated variants are available with an angle of 15 degrees. To insert, the head is oriented correctly and tapped firmly with a mallet.[14] It is impossible to remove it after tapping.

III. Non threaded, Cementable

The system using this modality is the Core-Vent design. Abutment selection will not be required until after 2nd stage of surgery.

Attachment of Abutment to Implants

Current systems use retaining screws for abutment attachments. Abutments for flat surfaced implants demand attachment of 1 piece attachments and are used only in multiple splinted implants. They lack anti rotation features. Abutments for implants with anti- rotation features inhibit unwanted movement. Those in current use include external hex, internal hex, spline[15] attachment and morse-taper[16] attachment.

Abutment Selection

The labial margin should extend atleast 1mm subgingivally. If extended more than 3mm, it is difficult to seat the abutment and remove excess cement. In case of discrepancy, a prep able abutment can be used. A vertical space of 3 mm allows for a good emergence profile. If flare is needed in a short vertical space a wide diameter prepable abutment can be used. For a slight labial angulation a standard abutment can be used. For an interocclusal space of 6-7 mm a standard abutment can be used. If lesser space is available a prep able abutment can be used. A screw type abutment is easier to retrieve whereas a cementable abutment is difficult to retrieve. In cases with special esthetic requirements a porcelain abutment can be used. Final restorations on metal abutments or porcelain abutments should be thick to avoid metal showing.

Complications: Fracture of endosteal blade abutments may be due to overstressing and galvanism, leading to cervical fracture or cement loss beneath an abutment of a natural tooth. Broken abutments of subperiosteal implants occur rarely. Screw loosening is the most common complication of abutments for endosteal implants.

Maintainance: If calculus is present on an abutment, debridement using a plastic instrument[17] is recommended. Polishing with a rubber cup & low abrasive pumice is acceptable, but ultrasonic scalers, stainless steel curettes and Titanium tipped instruments are not recommended in cases in which the surfaces of implant components can be damaged. In case of severe peri-implant mucositis the prosthetic component and the involved abutment is evaluated and removed. After evaluation of any iatrogenic factors (eg. marginal fit & design of prosthesis) the abutment should be cleaned in an ultrasonic bath to remove debris that accumulated intraorally.

Author affiliations: 1. Dr. Helen Mary Abraham, MDS, Senior Lecturer, 2. Dr. Jacob Mathew Philip, MDS, PhD Scholar, Reader, 3. Dr. Cakku Jalliah Venkatakrishnan, MDS, Ph D Scholar, HOD and Professor, 4. Dr. Rathinavelu Pradeep, MDS, Reader, 5. Dr. Muthusamy Narasimman, MDS, Reader, 6. Dr. Rathinavel Pandian, MDS, Senior Lecturer, Department of Prosthodontics, Tagore Dental College, Bharath University, 173, Agharam Road, Selaiyur , Chennai , Tamilnadu, India.

REFERENCES

1. Conrad HJ, Pesun IJ, DeLong R, Hodges JS. Accuracy of two impression techniques with angulated implants. J Prosthet Dent 2007 Jun; 97(6): 349-356.
2. Korioth TW, Cardoso AC, Versluis A. Effect of washers on reverse torque displacement of dental implant gold retaining screws. J Prosthet Dent. *1999 Sep;82(3):312-6.*
3. Potashnick SR. Soft Tissue Modeling for the Esthetic Single-Tooth Implant Restoration. J Esthet Dent. 1998;10(3):121-31.
4. Maló P, Nobre Mde A, Petersson U, Wigren S. A Pilot Study of Complete Edentulous Rehabilitation with Immediate Function Using a New Implant Design: Case Series. Clin Implant Dent Relat Res. 2006;8(4):223-32.
5. Pröbster L, Girthofer S, Groten M, Rein B. Copy-milled all-ceramic Celay-InCeram crowns for modified CeraOne abutments: a technical report. Int J Oral Maxillofac Implants 1996 ;11(2): 201-4.
6. Ohya K, Kanazawa M, Minakuchi S. Retentive force of stress-breaking attachments on maxillary implant overdentures. J Prosthodont Res. 2009 Apr;53(2):78-82.
7. Aboyoussef H, Weiner S, Ehrenberg D. Effect of an antirotation resistance form on screw loosening for single implant-supported crowns. J Prosthet Dent. 2000 Apr;83(4):450-5.
8. Londono J, Marafie Y. A device to hold implant abutments for extraoral preparations. J Prosthet Dent. 2009; 102(1): 55-56.
9. Mante FK, Seckinger RJ, Purinton D, Abreu SJ, Berthold P. An Investigation of the Impac Custom Abutment for Root Form Dental Implants. J Prosthodont. 1994 Mar;3(1):19-22
10. Vafiadis DC. Computer-generated abutments using a coded healing abutment: a two year preliminary report. Pract Proced Aesthet Dent. 2007; 19(7): 443-8.
11. Han J-S, Ahn C-Y, Shin S-W. Zirconia/Alumina Ceramic Abutments for Esthetic Implant Prostheses. Nihon Koko Inpuranto Gakkai Gakujutsu Taikai Shorokushu 2004; 34: 155.
12. Chee W. Jivraj S. Designing abutments for cement retained implant supported restorations. Br Dent J. 2006 Nov 11;201(9):559-63
13. Dinçer Bozkaya and Sinan Müftü. Mechanics of the taper integrated screwed-in (TIS) abutments used in dental implants. Journal of Biomechanics 2005; 38: 87-97.
14. Chapman RJ, Grippo W. The locking taper attachment for implant abutments: use and reliability. Implant Dent. 1996; 5 (4): 257-61.
15. Wee AG, McGlumphy EA. Prosthodontic Complications of Spline Dental Implants Implant Dent: 2003; 12: 151-159.
16. Cehreli MC, Akça K, Iplikçioğlu H. Force transmission of one- and two-piece morse-taper oral implants: a nonlinear finite element analysis. Clin Oral Implants Res. 2004 Aug;15(4):481-9.
17. Matarasso S, Quaremba G, Coraggio F, Vaia E, Cafiero C, Lang NP. Maintenance

of implants: An invitro study of titanium implant surface modifications subsequent to the application of different prophylaxis procedures. Clin Oral Implants Res. 1996; 7(1): 64-72.

Corresponding author:
Dr. Jacob Mathew Philip
Department of Prosthodontics,
Tagore Dental College, Bharath University,
173, Agharam Road, Selaiyur,
Chennai-600059, Tamilnadu, India.
Contact no: 91 9840588335
E-mail: jacobmphilip@gmail.com

How to cite this article: Abraham MH, Philip MJ, Venkatakrishnan JC, Pradeep R, Narasimman M, Pandian R. Implant Abutments – A Review. Rama Univ J Dent Sci 2016 June;3(2):13-17.
Sources of support: Nil **Conflict of Interest**: None declared