

Abutments in Implantology: A Review

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ABSTRACT

Background: The success of dental implants has changed treatment planning for patients with edentulous areas dramatically. 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. Implant abutments constitute the critical interface between osseointegrated implants and their prosthetic superstructure. A wide variety of abutment materials are available on the dental implant market. A major challenge for clinicians today is understanding the biologic response to each material, as well as the best indication for using each of the different types. This article provides relevant information on abutment material and an outline of the method of abutment selection.

Keywords: Implant abutments, connection, guidelines for use, extraoral implant abutments.

INTRODUCTION

The dental implant is rapidly becoming a cornerstone in the current practice of dentistry. A basic implant system may be considered structurally as comprising three distinct parts: a part which interfaces with the hard tissues; a part which interfaces with the soft tissues; and a part which interfaces with the oral environment. These different structural parts may take the form of either one, two or three separate components. The component that is osseointegrated with bone is usually referred to as the implant fixture and provides retention and support for the prosthesis. The abutment is the portion of implant that supports or retains a prosthesis or implant superstructure¹. The final component of the system is the restoration or superstructure which gains support and retention from the fixture through the abutment. Abutments effectively help to form the restorative part of the implant prosthesis. The abutment provides retention, support, stability and optimal position for the final restoration. With an increase in the availability of implant restorative

components, the selection of an appropriate implant abutment has become more challenging.

Most abutments are retained into the implant platform by a screw (Screw-retained) and the final crown can be screw retained directly onto the abutment (three tier system) or directly onto the implant platform (two-tier system). Alternatively, the crown can be cemented as in a conventional crown and bridge protocol (cement retained) onto the abutment which is retained to the implant by a screw (three tier system). Abutments can usually be separated from the implant, but in some cases they may form part of the implant itself. Additionally, not all implant restorations require abutments. In these cases, the crown is fabricated to be attached directly to the implant platform². This article has made an attempt to summarize a classification system to outline a method for abutment selection.

DENTAL IMPLANT ABUTMENT³

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The portion of a dental implant that serves to support and/or retain any fixed or removable dental prosthesis. Dental implant abutments especially those used with endosteal dental implants, are changed to alter abutment design or use before a definitive prosthesis is fabricated. Such a preliminary abutment is termed as INTERIM ABUTMENT. The abutment chosen to support the definitive prosthesis is termed a DEFINITIVE ABUTMENT.

TYPES OF ABUTMENT²

❖ According to method by which prosthesis or superstructure is retained to abutment :

- **Screw retention-** Uses screw to retain prosthesis or superstructure
- **Cement retention-** Uses dental cement to retain prosthesis or superstructure
- **Attachment-** Uses attachment devices like magnet or O ring

Each of the types of abutments may be further subclassified as:-

1. Straight
2. Angled

❖ Based on rotational devices:-

- One piece abutment:- No antirotational devices
- Two piece abutment:- Antirotational devices

❖ According to form obtained from manufacturer:-

- Machined form
- Custom cast using gold or plastic components

❖ Depending upon abutment design:-

- Flat topped abutment
- Tapered shouldered abutment
- Direct gold copings

Commercially available

- Steri oss abutment
- Paragon abutment
- Ceraone abutment
- Ceradapt abutment
- UCLA abutment

- Noble bio care abutment
- Estheticone abutment
- Mirus cone abutment
- Noble pharma single tooth abutment
- Branemark system angulated abutment
- Astra abutment

A) CEMENT RETAINED ABUTMENTS⁴:

ADVANTAGES-

- Simplicity-A familiar and relatively simple technology
- Passivity-A passive fit is theoretically possible
- Angulation-Less of a problem than with screws, no access hole

DISADVANTAGES

- Retrievability-Difficult or impossible to remove without damaging superstructure
- Cement excess-Difficult to avoid, detect and remove

B) SCREW RETAINED ABUTMENTS⁴:-

ADVANTAGES

- Retrievability-Easy to remove
- Control of gap-This can be precise
- Predictable failure-Can be designed as a weak point in the system

DISADVANTAGES

- Mechanical failure-Can be problematic
- Access holes-Necessary for screw placement
- Contamination- Can permit ingress of material and microorganisms from the mouth
- Angulation problems- May be very difficult to manage where long axis of crown diverges markedly from that of the implant body.

C) STRAIGHT AND ANGULATED ABUTMENTS⁵:-

The implant abutment may be restored as a natural tooth restoration. The two piece abutment for cement (straight or angled usually prefabricated) is inserted into implant body. The anatomy of the jaws and the morphology of the residual ridges determine the orientation and angulation of implant placement. Similarly, the position and morphology of the teeth are determined by esthetic and functional

considerations. In the majority of situations, there is a difference between the long axis of the implant and the long axis of the planned tooth replacement.

D) BASED ON FORM^{6,7}

STOCK ABUTMENTS:- Stock abutments are generally made of prefabricated titanium. These types of abutments should be modified in the lab or intra-orally so they can support a transitional crown or a final crown or bridge. Implant companies have improved the design of these types of abutments over the years to allow a better emergence profile.

Temporary Abutments²: Temporary abutments are usually produced in a stock prefabricated fashion, in that they are machine premade. They include impression abutments, healing abutments and metal or plastic provisional abutments. The increased popularity of implant-supported dentistry in the esthetic area raised concerns of visible discoloration resulting from the titanium metallic color showing through thin gingival tissues. Furthermore, greater use of all-ceramic restorations resulted in a need for an abutment that did not diminish their natural translucency and vitality.⁸

TITANIUM ABUTMENT⁹: Surface roughness is the key difference between machined and polished titanium. Prefabricated abutments with a Laser-Lok surface characteristic are a new innovative product. The Laser-Lok consists of 8–12 micron titanium micro-channels.

ZIRCONIA⁹: Zirconium dioxide (ZrO_2), also known as zirconia (not to be confused with zircon), is a white crystalline oxide of zirconium. The zirconia used in dentistry is chemically similar but not necessarily alike crestal bone stability. Zirconia abutments provide a less plaque-retentive environment around a final prosthesis compared with any other type of abutment material.

POLYETHER ETHER KETONE (PEEK)⁹

PEEK has become the most popular material for fabricating temporary abutment. It is a beige or white colored organic polymer and a semicrystalline thermoplastic with excellent mechanical and chemical resistance properties.

CUSTOMIZED ABUTMENTS:-

Customized or custom abutments first became popular after the UCLA abutment was introduced to the market. UCLA abutments provide a means for waxing the emergence profiles of the transgingival portion of the abutment, flexibility in margin level placement, and the correction of angulation problems. There are three major techniques of customizing implant abutments:

1. Milling (starting from a bulky titanium abutment)
2. Manual modeling (creating a model for casting or scanning)
3. Virtual modeling (designing a model in a virtual environment)

The dentist has a choice during the final fabrication to use either a **standard prefabricated, custom castable or computer generated abutment**. CAD/CAM Abutments versus regular cast custom abutments- CAD/CAM Abutments are precision created by smart software requiring no lab technician skill or knowledge to obtain an optimally shaped custom abutment. The surface characteristics of a virtually design abutment are superior to cast abutments because each abutment is precision milled and highly mechanically polished.¹⁰

E) CLASSIFICATION DEPENDING UPON IMPLANT ABUTMENT CONNECTION¹¹

EXTERNAL HEX CONNECTIONS:-

Advantages of the external hex connection

- Long-term follow-up data are available
- Compatibility among multiple implant systems
- Solutions to complications are found throughout the literature due to their extensive use

Disadvantages of the external hex connection

- Higher prevalence of screw loosening
- Higher prevalence of rotational misfit
- Less esthetic results
- Inadequate microbial seal

INTERNAL CONNECTIONS:-

Advantages of the internal connection

- Less screw loosening
- Better esthetics
- Improved microbial seal

- Better joint strength
- More platform switching options

Disadvantages of the internal connection

- The weakest link is the bone rather than the retaining prosthetic screw
- There is less historical literature on internal connections than external connections

GUIDELINES FOR ABUTMENT SELECTION¹²

1. Implant-Abutment Connection
2. Implant Restorative Platform (Diameters in Millimeters)
3. Emergence Profile of Healing/Interim Abutment (Diameters in Millimeters)
4. Orientation of Implant(s)
5. Interocclusal Distance
6. Depth of the Peri-implant Soft Tissues

EXTRAORAL IMPLANT ABUTMENTS^{13,14}

BAR CONSTRUCTION AND RETENTIVE CLIPS:-

A bar construction is a wire soldered to gold cylinders and mounted onto the abutments by gold screws. Such a construction provides a good load distribution on the implants. For auricular prostheses and for large orbital prostheses where implants have been placed in the upper orbital rim, this kind of retention is recommended.

INDIVIDUAL MAGNETS:

The individual retention system consists of a magnet cap that is threaded onto the abutment and a magnet placed into the fitting side of prosthesis. In an orbital defect with implants in the upper and lower orbital rim, the individual magnet system is recommended. It is especially recommended when there is a shallow defect with insufficient space for a bar-and-clip construction.

BALL ATTACHMENTS:

When there is a shallow defect, the ball attachments are an option of retention because they take little space behind prosthesis. Three implants creating a tripod are imperative to provide satisfactory retention and stability.

CONCLUSION

Titanium and zirconia abutments are currently the most commonly used prosthetic parts used to support the final prosthesis. Factors contributing to the overall esthetic result may include the anatomy of the implant sites (gingival biotype, shape of adjacent teeth, bone level at adjacent teeth), placement of the implants (oral-facial position, mesial-distal position, coronal-apical position, distance between tooth-implant or implant-implant), the hard/soft tissue management procedures during the implant treatments, and the design or prosthetic management of provisional/definitive restorations.

CONFLICT OF INTEREST

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

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