

# DEMYSTIFYING DENTAL IMPLANT ABUTMENTS- CLASSIFICATION AND SELECTION CRITERIA

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## Abstract:

*The implant abutment is a component that is still facing criticism in selection and usage due to the wide variety being made available in the market which puts the clinician in a dilemma to select the right choice. This article highlights the types, classification and important criteria which help in implant abutment selection and gives a brief review on the recent advances in implant abutments.*

**Keywords: implant abutment, abutment selection, abutment material, abutment**

## Introduction

Today, with the ever-increasing popularity on dental implants, there are a wide variety of implant components and parts available. One of the most confusticate tasks faced by an implant clinician is the implant abutment selection.

Abutment selection during treatment planning saves a lot of time and cost as it enables the clinician to decide for a stock or custom abutment prior to surgery.

This article highlights the types, classification and important criteria which help in implant abutment selection and gives a brief review on the recent advances in implant abutments.

## The Tier System

There are 2 main systems integrating implant components, the three-tier or two-tier system.

A three-tier system has three separate components, the implant, the abutment and the

crown whereas a two-tier system incorporates two separate components, the abutment and the crown to form a single unit and the implant is a separate component or, the implant and the abutment form a single unit and the crown is separate.<sup>1</sup>

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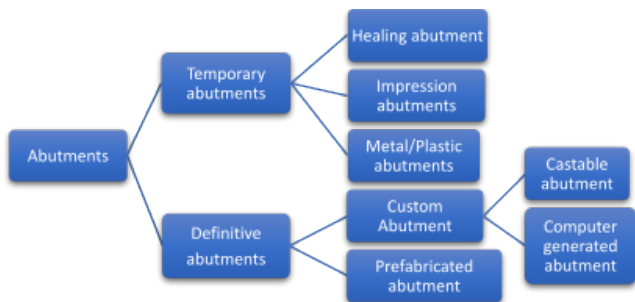
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## Abutment Classification

There are several classifications for implant abutments-

- I) Based on connection type- Screw retained/ Cement retained<sup>2</sup>
- II) Based on connection interface- Engaging/ Non engaging
- III) Based on location of hex -external or internal
- IV) Based on connection mechanics – slip fit joint(passive)  
Or as friction fit (active)
- V) Based on Material used- Titanium, Zirconium, BioHPP Polymer based
- VI) Based on contact between mating surfaces- Butt joint  
Or bevel joint
- VII) Based on fabrication – CAD-CAM and conventional
- VIII) Overdenture abutments- bar- clip systems, Ceka attachments, Ball stud attachments, Magnetic attachments<sup>3</sup>

### Classification based on Usage



### Temporary abutments

They are used for a definitive period in order to shape gingival tissues, helping to create an emergence profile, establishing esthetics phonetics in the final restoration. They play a major role in the outcome of the final restoration. <sup>1</sup>

### The healing abutment

The healing abutment protects the implant platform and aids in preventing soft tissue and bone growth onto the crestal area. It protects the surgically placed implant from oral fluids and epithelial ingrowth. One stage or 2 stage protocol is followed whereby the former allows the healing abutment to be exposed during healing phase and allows direct accessibility to the implant platform. The two- stage protocol requires the submerged implant platform under the soft tissue to be uncovered in a surgical manner.

### Impression abutment

Factors	Transfer Cop- ing	Pick up copings
Interarch space	Less space needed for impression, suitable for posterior areas	More space needed to accommodate the larger copings
Tray preparation	No preparation necessary	Tray should be perforated to accommodate the copings
Splinting multiple copings	Not possible	Possible
Precision of impression	Possibility of distortion as the copings have to be reinserted into the impression	Less distortion as the coping remains in the impression.

Commonly known as copings, there are two types based on the clinical scenario. The Pickup or direct copings for is for the open tray impression whereas the Transfer or indirect copings is for the closed tray impressions.

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## *Metal or plastic abutments*

These abutments are mainly used for provisionalization and mainly help in soft tissue contouring and establishing occlusion prior to the final restoration. It can be prefabricated or customised according to the patient profile.

## **Definitive abutments**

### *Prefabricated Abutment*

Prefabricated abutments, being manufactured by implant companies are of varying configurations, may be selected directly by an implant or fixture level impression or it may be directly selected and a crown fabricated.

### *Custom Abutment*

The custom abutment is suited for more complex and esthetic areas, can be fabricated in a dental laboratory or milled by CAD CAM, requires precise impression to be made at the implant fixture level.

### *Castable abutments*

These are waxed up and customised for the restorative space. It requires labour intensive procedures like waxing, investing, and casting with alloys at high temperature. This makes it costly, time consuming, and involves more complex laboratory procedures<sup>4</sup>

### *Computer-generated abutments*

CAD/CAM technology was introduced in the 1980s. It uses data from a computerised tomography scan. The CT images are converted into data that are recognized by a software.<sup>5</sup> It ensures precision which is crucial in implant dentistry for fit, stress distribution, longevity, passivity, and long-term success.<sup>6,7</sup>

## **Abutment Selection Criteria**

1) *Implant position* – Proper implant position in the buccolingual and mesiodistal position is a prerequisite to a good prosthesis. Any

discrepancies in position not only compromises the final restoration and adjacent teeth but also leads to improper biologic contours, incorrect location of access opening, and also leads to non-axial loading of the implant.<sup>1</sup>

2) *Implant angulation* – If the angulation is less than 15 degree any abutment can be used. If the angulation is 15- 35 degree, the custom or angulated or cemented abutments is to be used. If the angulation is greater than 35 degree necessitates the custom abutment or the implant may not be restorable.<sup>1</sup>

3) *Interocclusal space* – It is the vertical distance between the superior surface of the implant and opposing dentition in maximum intercuspation. This space approximates to the total space available for the abutment and the restoration.<sup>8</sup>

4) *Tissue height/ sulcular depth* – It is the distance from the crest of the implant to the gingival margin. It is an important when a subgingival margin is planned. It is measured 6-8 weeks following stage 2 surgery. In esthetically important locations, it is ideal to place the margin of the restoration 1- 2 mm subgingivally.<sup>1</sup>

### 5) *Implant-abutment interface geometry*

The external hexagon was introduced early on into the dental implant systems. However, its main drawbacks included abutment screw loosening and fracture<sup>9</sup> Consequently, these may cause mechanical irritation of the tissues and ingress of bacterial toxin fluids, affecting the stability of dental implants.<sup>10</sup> When compared to external hex connections, internal hex connections have a number of advantages, including the ability to distribute intraoral forces deeper within the dental implant, which reduces stress on the crestal bone, prevent excess screw loading, lessen the possibility of microleakage, and improve joint interface strength.<sup>11</sup>

### 6) *Implant restorative platform (diameter in mm)*

Implant restorative platforms are the interfaces for implant-abutment connections. The diameter chosen may be the same as or narrower than the

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implant, depending on the size of the teeth that are being replaced.<sup>12</sup>

## Abutment Categories

Abutment can be categorised for use with any hexagonal root form implants

Sl. No	Abutment type	Minimum interocclusal space	Minimum collar height
1.	Standard	5	2
2.	Conical	4.5	1
3.	Cylindric	2.8	0
4.	Angulated	7.5	1
5.	Cementable Core	6.0	1
6.	Post	3.5	0
7.	Custom	4.5	0

Implant level restoration (2 tier system)

### Cylindrical abutment

It is the only implant level (2 tier system) restoration available. Commercially it is known as UCLA or gold UCLA. It is available with a collar height less than 1mm and requires an interocclusal space of 3.5 mm.<sup>1</sup>

Abutment level restoration (3 tier system)

### Standard abutment

It varies from 2-8mm of collar height and requires 5mm of interocclusal space. Multiple units can be placed in non esthetic areas. It is supragingival and easily cleaned.

### Conical Abutment (Esthetic zone)

It has a more esthetic emergence profile due to more subgingival placement. Single or multiple units can be places in esthetic areas. There is a problem of interproximal tissue collapse into the abutment due to collar height being uniform.<sup>13</sup>

### Angulated abutment

It is used in cases of angulation and positional discrepancies. It has a disadvantage of tissue impingement problem caused by ledge.<sup>14</sup>

### Cementable Core (Ceraone System)

It is indicated in highly esthetic single tooth abutments. The screw deforms inside the implant and increases retention.

### Post Abutment

It is screwed into the implant or cast and prepped as tooth in fixed prosthesis. The preparation is refined intraorally, crown fabricated and cemented over the post.

### Custom Abutment

It enhances the esthetic emergence as it can be customised to match individual cases. The main drawback is the increased lab cost and orientation problems which occur due to the 6 different positions in which the abutment is placed.



Cylindrical Abutment

Standard Abutment



Cementable Core (Cera One System)



Conical Abutment

Angulated Abutment

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Custom Abutment



Post Abutment



## Recent Advances

### 1) Syncone abutments

Prefabricated telescopic conical abutments having a 4° angulation (SynCone System, Friadent, Mannheim, Germany). The prefabricated abutments are designed to fit precisely into secondary copings that are placed into the denture's base. When compared to bar-retained dentures, they allow for improved oral cleanliness and drastically lower the cost of fabricating customized castings.<sup>15</sup>



### 2) Multiunit abutments

Multi unit abutments are intended to be connectors between dental implants and multiple implant screw retained restorations. These are mainly indicated for multi unit screw retained restorations. It can either be straight or angulated and be of varying heights from between 1 to 5mm.<sup>2</sup>

A major advantage is that when the multi unit abutments are placed at the time of surgery, they don't have to be removed for the impression which aids in preserving the adherent epithelial and connective tissues. Using a multi unit abutment will also bring the margin of the restoration closer to the tissue level which can make it much easier to seat the restoration.<sup>16</sup>

### 3) Digital abutments for scanning

Transferring the ultimate implant position to the final restoration is the goal of an implant clinician. Implant-supported full-arch frameworks can be recorded best with digital impressions. Scan-bodies are typically fastened into implants in order to create digital impressions.

A scanning abutment is a type of abutment that is used to transmit data related to the angulation and position of seated implants. The data is collected with a digital desktop scanner or an intra-oral scanner and is extremely accurate. It is important to consider transmission faults brought on by the usage of scan-bodies.<sup>17</sup>



### 4) Zirconia and PEEK abutments

The use of alternative materials for implant abutments were deemed necessary due to gray zone effect created by Titanium abutments in peri implant marginal mucosa, which reduces patient esthetics and satisfaction. Zirconia( polycrystalline ceramic material) reduces the greying effect on the mucosa and promotes adequate esthetics and durability.

High Performance Polymer (Bio-HPP) are polyetheretherketone (PEEK) based biomaterials, that have been developed as a promising alternative, is a semi-crystalline linear polycyclic



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thermoplastic that has many advantages including lower hypersensitive and allergic reactions, radiolucency and it reduces the incidence of artifacts on magnetic resonance imaging.<sup>18</sup>



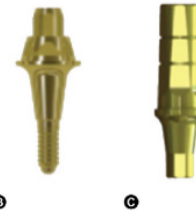
## 5) UCLA abutments

When the UCLA abutment was first introduced in 1987, its goal was to have the best possible aesthetics. It also resolves issues with implant angulation, soft tissue response, limited interocclusal and interproximal distances, and implant angulation. It is possible to correct an angle of up to 30 degrees. For cosmetic reasons, tooth color can be customized, and the healing period is comparable to that of other abutment materials.<sup>8</sup>



## 6) Key solution ( Ks) implant system

KS implant system provides durable stability for patients and easy access and manipulation for dentists. With an internal hexagonal connection and 15 degree morse taper. It has enhanced strength and fracture resistance. The surface of the KS system is coated with barium, a super-hydrophilic coating that boosts osseointegration by increasing blood adhesion. The substance is 100% bioabsorbable and provides excellent healing efficacy.<sup>8</sup>



## 7) Locator Abutments

The locator abutment is a popular choice for implant retained or implant supported overdenture due to its low level of thickness ( 2.5 mm) and ability to self align, which can correct upto 40 degree of implant angulation. It provides excellent retention and stability and offers for easy hygiene maintainance. It can be used in cases of narrow inter arch space and prevent fracture of denture base. <sup>8</sup>



## 8) Morse Taper abutments

A unique design feature of the Morse taper implant-abutment connection is an internal joint design between two conical structures. The substantial proclivity for parallelism between the two structures in the joint space results from this internally tapered design, which causes a great deal of friction. It has reduced biofilm accumulation, less periimplantitis when placed supracrestally, Reduced resorption of crestal bone<sup>19</sup>



## 9) Platform Switching Abutments

When an abutment is used that is smaller in diameter than the implant platform, this is referred

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to as platform switching, also known as platform shifting. The long-term stability and success of the implant depend on preventing crestal bone loss, which can be achieved by switching platforms. Additionally, it may increase the amount of soft tissue surrounding the implant platform, which will enhance the esthetic end result.<sup>19</sup>



## Conclusion

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. The implant clinician should select the abutment during planning of the restoration. The overwhelming number of abutments available become more manageable if they're categorized by their properties into certain groups based on the criteria. The implant abutment connection, material, retention type, and production techniques of these abutments differ. Since every implant case is unique, clinicians should be able to recognize the needs of each one and select the best abutment on the market.

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