

# Abutment Selection for Anterior Implant-Supported Restorations

Emna Boudabous<sup>1\*</sup>  
 Ilhem Ben Othmen<sup>2</sup>  
 Balkis Khadhraoui<sup>3</sup>  
 Imen Kalghoum<sup>4</sup>  
 Dalenda Hadyaoui<sup>5</sup>  
 Zohra Nouira<sup>6</sup>  
 Harzallah Belhassen<sup>7</sup>  
 Mounir Cherif<sup>8</sup>

Department of Fixed Prosthodontics, Research Laboratory of Occlusodontics and Ceramic, University of Monastir, Tunisia

Corresponding Author:- Emna Boudabous<sup>1\*</sup>

**Abstract :-** With Innovative and technological advances in implant dentistry various implant brands and their components are made available in the markets that vary in terms of design and other features. Implant abutment is the link between implant and restoration. The right selection of this abutment is essential for the success of implant prosthesis. There are varieties of implant abutments available in the market. Clinician should have adequate knowledge about these abutments and various factors that affect abutment selection, to choose the right one. Each implant case is different and clinician should be able to identify requirements of every individual case and choose the best suitable abutment available in the market. These abutments vary in implant abutment connection, material, type of retention, and fabrication methods. Hence this article summarizes complete information about the implant abutments, including, types, selection, and different abutments available in market.

**Keywords:-** Morse Taper , Zirconia Abutment , Titanium Abutment , Hybrid Abutment , Anterior Region ,Angled Abutment , Straight Abutment.

## I. INTRODUCTION

The implant abutment is the intermediary component between the implant and the crown, emerging into the oral cavity. To establish an emergence profile that is similar to that of the natural tooth, improve soft tissue stability, and prevent tissue recession, the prosthetic abutment should be concave and narrowed inward at the transmucosal level.

The right selection of this abutment is essential for the success of implant prosthesis.

There are varieties of implant abutments available in the market. Clinician should have adequate knowledge about these abutments and various factors that affect abutment selection, to choose the right one. These abutments vary in implant abutment connection, material, type of retention, and fabrication methods. Hence this article describes informations

about the implant abutments, including, types, selection, and different abutments available in market.

### A. Functions

The prosthetic abutment serves five critical functions that are of paramount importance. These functions include establishing a physical connection between the implant and the prosthetic crown, efficiently transmitting forces to the implant without the risk of bone overload or fracture, establishing and maintaining an epithelial and connective attachment between the peri-implant mucosa and the abutment that remains non-inflammatory, providing a prosthetic restorative platform to which the clinical crown can be esthetically and durably attached, and achieving a harmonious and esthetic emergence profile according to each clinical situation.

### B. Implant Abutment Connection

For two-stage implant systems, the connections are classified into two main categories according to whether the male and female elements belong to the implant or the abutment (external or internal).

In the case of a single incisor replacement, the connection must be anti-rotational and also called indexed: in this case the connection has positioning markings and it is possible to report precisely the position of the abutment in the implant neck.

➤ *At the Anterior Level, the Morse Taper Connection is Preferred because it Allows: (2)*

- *More Vertical Space For The Abutment-Implant Complex And Therefore An Optimized Emergence Profile*
- *A More Accurate Tactile Impression.*
- *Better Antibacterial Sealing.*
- *Better Resistance To Lateral Bending Forces*

### ➤ Comparison of Connections

The biological (hermeticity of the connection), mechanical (stability under stress) and ergonomic properties of the different connection types are summarized in the following table from recent studies and systematic reviews.

Table 1 Summary of A Comparison of the Different types of Implant Connection

Connection Type)	Mechanical Properties (3–8)	Biological Properties (9)	Ergonomic Properties (1,10)
External Connection	-Significant micromovements between abutment and implant - Low resistance to unscrewing of the abutments - Technical complications, prosthetic or implant failures may occur.	Risk of dehiscence -Low bacterial resistance - Increased bone loss in subcrestal position	-Limited tactile sensation
Internal Connection	-Lower micromovements between abutment and implant -Better resistance to unscrewing/fracture - Better stability than external connection	-High bacterial resistance	-Clear feeling of full engagement
Morse Taper	Maximum increase of the contact surface allows: -High stability -Reduced risk of unscrewing and/or fracture of the screw -No risk of overloading the peri-implant bone -Greater strength -A distribution of forces along the implant -Tight implant-abutment connection	- No gap between abutment and implant -No bacterial contamination -No bone loss -Stability of the peri-implant soft tissue -Possibility to position the implant subcrestal	-Lower final seating sensation - Increased friction

C. Choice of Abutement

➤ Choice of Material

In implantology, the choice of the prosthetic abutment is a crucial phase for the success of implant-supported rehabilitations.

The selection of materials is based on several factors, such as long-term mechanical stability, biocompatibility with respect to the tissue microenvironment, esthetics, the type of periodontium, and cost. The titanium abutment exhibits excellent mechanical properties, including high mechanical strength and a modulus of elasticity close to that of the implant, as well as superior biological properties, such as biocompatibility, corrosion resistance, and promotion of soft tissue healing. However, the grayish coloring of titanium in the presence of very thin soft tissue compromises the aesthetic result, especially for maxillary incisors. The use of titanium at the anterior level is only necessary in the presence of para-function, such as bruxism, to avoid any risk of mechanical complication. The zirconia abutment, on the other hand, exhibits very good stability, excellent biocompatibility with the surrounding environment, and excellent tissue integration. Due to its optical properties, zirconia is ideal for use in the anterior sector, particularly in cases of thin periodontals and gingival smiles. However, its weak point is the risk of fracture.



Fig 1 Zirconia Abutment

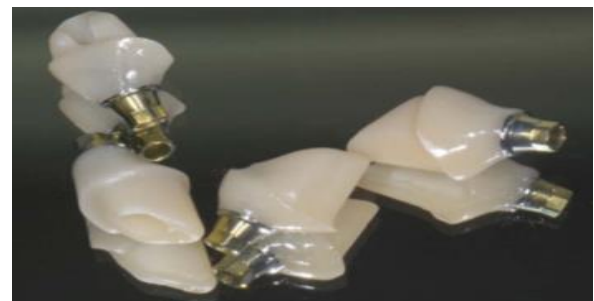


Fig 2 Hybrid Abutment

The use of hybrid abutments, which combine a machined titanium base with a zirconia or lithium disilicate suprastructure, is indicated in the anterior superior or inferior sector due to the mechanical reliability of the connection, aesthetic appearance, biocompatibility, and other factors.

The comparison of materials reveals that zirconia abutments have a susceptibility to fracture, which can play a protective role for the implant and its fittings, whereas the titanium abutment reveals a plastic deformation involving not only the abutment but also the screw. (13)A review of the literature conducted in 2018 reports a satisfactory survival rate of treatments with zirconia abutments at 5 years, regardless of the type of prosthesis supported or their location, associated with an adequate biological stability not superior to that of titanium abutments. (12) An in vitro study conducted in 2017 reports that when the buccal gingival thickness is ≤3mm, the abutment used should be zirconia, and when the gingival thickness >3mm, there will be no aesthetic problems due to the use of a titanium abutment. A 2017 study of bacterial biofilm development on the surface of a zirconia and titanium abutment reported superior bacterial colonization for zirconia.(14)

➤ Choice of Abutment According to Manufacturing Method  
Cast-in Abutments

➤ *There are Two Types of Cast Abutments:*

- The UCLA type abutment: it consists of a machined base in precious metal (gold or palladium), topped by a fully calcinable cylinder that can be modified by subtracting or adding wax, thus allowing an over-casting in a material compatible with the base.
- The fully burnout UCLA abutment: it has no machined base, which is strongly discouraged because it is poorly adapted to the implant neck. (11)

➤ *These Abutments have Advantages and Disadvantages as Listed in the following table:*

Table 2 Advantages and Disadvantages of Cast-in Abutments

Avantages	Disadvantages
<ul style="list-style-type: none"> <li>- Achieving the ideal emergence profile</li> <li>- Correcting the divergence between the implant axis and the prosthetic axis (maximum 30°)</li> </ul>	<ul style="list-style-type: none"> <li>- High cost in time and alloy</li> <li>-More complicated implementation, errors may occur./which increase the risk of errors (101)</li> <li>-Risk of polymetalism</li> </ul>

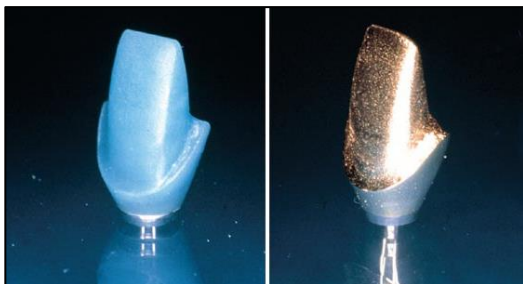


Fig 3 Wax-Up from the UCLA Abutment. the Machined Gold base is Left Untouched to Fit the Implant Neck/Gold Stump Cast from the Wax-Up

D. *Machined Abutments*

➤ *Prefabricated Machined Abutments*

These abutments have a standard morphology proposed by the manufacturers that can be adapted to the vast majority of patients. They are available in different diameters and heights, which depend on the implant diameter and the height of the peri-implant mucosa.

➤ *The Advantages and Disadvantages of these Abutments are Listed in Table*

Table 3 Advantages and Disadvantages of Prefabricated Machined Abutments

Avantages	Inconvénients
<ul style="list-style-type: none"> <li>-Simple protocol</li> <li>-A possible adaptation of the emergence profile.</li> <li>-Good biocompatibility</li> <li>-Catching up with the implant axis</li> <li>-Only high adjustments are permitted.</li> <li>- Low cost</li> </ul>	<ul style="list-style-type: none"> <li>-The trans-gingival height is limited</li> <li>-Problem of axis divergence &gt;15°.</li> <li>-These abutments cannot be modified ; altering them may interfere with the impression and thus the accuracy of the implant prosthesis. (90)</li> </ul>

➤ *These Prefabricated Abutments are Available in three Types, Each with Specific Indications.*

Table 4 Types and Indications of Prefabricated Machined Abutments

Types	Indications
<p><b>Angled Abutment:</b> has heights of 2 to 6 mm depending on the peri-implant mucosa with angulations of 15 and 25, 15 and 30 degree in the cemented version and 17, 25, 30 and 35 degree in the screwed version.</p>	<ul style="list-style-type: none"> <li>- Interocclusal space must be large <math>\geq 9</math> mm.</li> <li>-Soft tissue thickness <math>\geq 3</math>mm</li> <li>- Adjusting the implant axes for occlusal emergence of the screw shafts and correcting minor positioning errors</li> </ul>
<p><b>Straight abutment:</b> has a collar of the same height around its entire circumference.</p>	<p>It can be used when the implant is parallel to the adjacent teeth in the vestibulo-lingual and mesio-distal planes.</p>
<p><b>Tapered abutment:</b> is available with 1, 2, 3, 4 and 5.5mm high necks.</p>	<p>In aesthetic areas, as it allows the creation of an aesthetic emergence profile because the cervical edges of the prosthesis are subgingival.</p> <ul style="list-style-type: none"> <li>- Positioning of slightly convergent or divergent implants</li> </ul>

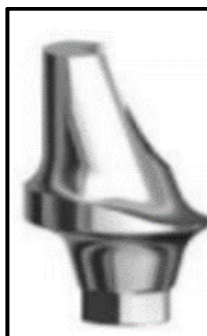


Fig 4 Angled Abutment



Fig 5 Straight Abutment



Fig 6 Tapered Abutment

➤ Customized abutments designed and produced by CAD/CAM(12)

CAD/CAM technology was introduced into the production of implant abutments in the 1980s. Customized abutments offer several advantages and disadvantages, which are summarized in the following table:

Table 5 Advantages and Disadvantages of Custom Abutments

Avantages	InDisadvantages
- An abutment adapted to the clinical situation with different emergence profiles and angulations. - Reduction of errors - Saves time - Adaptability between different implant brands	- Matching problems between implant and abutment, between different suppliers - Have relative strength problems between the titanium of the implant and that of the abutment.

➤ The following Table is a Summary of the Correct Choice of Prosthetic Abutment :

Table 6 Tableau Récapitulatif Du Choix Du Pilier Implantaire

		Choice of the Implant Abutment	
<b>Implant Inclination</b>	<15°	Any Type of Abutment can be used Except the Angled Abutment	
	between 15° and 30°,	Prefabricated or Custom Angled Abutment	
	>30°,	A Customised Abutment	
<b>Available Prosthetic Space</b>	<7mm	Overbuilt Abutment	
	>7mm	Any Abutment Type	
<b>Soft Tissue Thickness</b>	Oral Gingival Thickness is ≤2mm	Zirconia/Hybrid Abutment	
	gingival thickness >2mm	Titanium/Zirconia/Hybrid Abutment	
<b>Single Unit Restoration</b>		Abutment is with Anti-Rotational System	
<b>Type of Prosthesis</b>	Cemented Prosthesis		
	Screw-Retained Prosthesis :	One-Piece Prosthesis	Prefabricated Standard Abutment, Cast Abutment, or Customized Abutment
		2-Stage Prosthesis	- Cast in Abutment
		Standard Abutment	

➤ The Literature Perspective:

A review of the literature on CAD/CAM protocol abutments reports benefits in terms of structural accuracy of adaptation of the substructure and passivity to insertion of the abutment into the implant. (15)

The custom abutment is more suitable for the gingival margin than the prefabricated abutment.

According to Lops D et al, prefabricated abutments offer locking capabilities of the implant-abutment connection similar to CAD/CAM abutments. (16) However, some authors show a superior papillary recession with the use of a prefabricated abutment compared to custom abutments from CAD/CAM technology.(17)

In the case of incisor replacement, especially in the maxilla, the use of a custom abutment in the anterior region is preferred to acquire an adequate emergence profile for each clinical situation, which results in improved esthetics.

**II. CONCLUSION**

Each implant case is different and clinician should be able to identify requirements of every individual case and choose the best suitable abutment available in the market.

**REFERENCES**

[1]. Demurashvili G, Davarpanah K, Rajzbaum P, Szmukler-Moncler S, Davarpanah M. Manuel d’implantologie clinique: Concepts, intégration des protocoles et esquisse de nouveaux paradigmes - 4eme édition. Rueil-Malmaison: CDP; 2018. 656 p.

[2]. Velasco Bohórquez P, Rucco R, Zubizarreta-Macho Á, Montiel-Company JM, de la Vega Buró S, Madroño EC, et al. Failure Rate, Marginal Bone Loss, and Pink Esthetic with Socket-Shield Technique for Immediate Dental Implant Placement in the Esthetic Zone. A Systematic Review and Meta-Analysis. Biology (Basel). 18 juin 2021;10(6):549.



- [3]. Zipprich H, Weigl P, Ratka C, Lange B, Lauer HC. The micromechanical behavior of implant-abutment connections under a dynamic load protocol. *Clin Implant Dent Relat Res.* oct 2018;20(5):814-23.
- [4]. Majzoub J, Ravida A, Starch-Jensen T, Tattan M, Suárez-López del Amo F. The Influence of Different Grafting Materials on Alveolar Ridge Preservation: a Systematic Review. *J Oral Maxillofac Res.* 5 sept 2019;10(3):e6.
- [5]. Mishra SK, Chowdhary R, Kumari S. Microleakage at the Different Implant Abutment Interface: A Systematic Review. *J Clin Diagn Res.* juin 2017;11(6):ZE10-5.
- [6]. Mangano C, Iaculli F, Piattelli A, Mangano F. Fixed restorations supported by Morse-taper connection implants: a retrospective clinical study with 10-20 years of follow-up. *Clin Oral Implants Res.* oct 2015;26(10):1229-36.
- [7]. Esposito M, Maghaireh H, Pistilli R, Grusovin MG, Lee ST, Trullenque-Eriksson A, et al. Dental implants with internal versus external connections: 5-year post-loading results from a pragmatic multicenter randomised controlled trial. *Eur J Oral Implantol.* 2016;9 Suppl 1(2):129-41.
- [8]. Gracis S, Michalakis K, Vigolo P, Vult von Steyern P, Zwahlen M, Sailer I. Internal vs. external connections for abutments/reconstructions: a systematic review. *Clin Oral Implants Res.* oct 2012;23 Suppl 6:202-16.
- [9]. Bittencourt ABBC, Neto CL de MM, Penitente PA, Pellizzer EP, dos Santos DM, Goiato MC. Comparison of the Morse Cone Connection with the Internal Hexagon and External Hexagon Connections Based on Microleakage – Review. *Prague Med Rep.* 2021;122(3):181-90.
- [10]. Yilmaz B, Seidt JD, McGlumphy EA, Clelland NL. Displacement of screw-retained single crowns into implants with conical internal connections. *Int J Oral Maxillofac Implants.* juin 2013;28(3):803-6.
- [11]. Karunagaran S, Paprocki GJ, Wicks R, Markose S. A review of implant abutments--abutment classification to aid prosthetic selection. *J Tenn Dent Assoc.* Fall-Winter 2013;93(2):18-23; quiz 23-4.
- [12]. Naveau A, Rignon-Bret C, Wulfman C. Zirconia abutments in the anterior region: A systematic review of mechanical and esthetic outcomes. *J Prosthet Dent.* mai 2019;121(5):775-781.e1.
- [13]. de Avila ED, Vergani CE, Mollo Junior FA, Junior MJ, Shi W, Lux R. Effect of titanium and zirconia dental implant abutments on a cultivable polymicrobial saliva community. *J Prosthet Dent.* oct 2017;118(4):481-7.
- [14]. Thoma DS, Ioannidis A, Cathomen E, Hämmerle CHF, Hüsler J, Jung RE. Discoloration of the Peri-implant Mucosa Caused by Zirconia and Titanium Implants. *Int J Periodontics Restorative Dent.* févr 2016;36(1):39-45.
- [15]. Abduo J. Fit of CAD/CAM implant frameworks: a comprehensive review. *J Oral Implantol.* déc 2014;40(6):758-66.
- [16]. Lops D, Meneghello R, Sbricoli L, Savio G, Bressan E, Stellini E. Precision of the Connection Between Implant and Standard or Computer-Aided Design/Computer-Aided Manufacturing Abutments: A Novel Evaluation Method. *Int J Oral Maxillofac Implants.* févr 2018;33(1):23-30.
- [17]. Lops D, Parpaiola A, Paniz G, Sbricoli L, Magaz VR, Veneze AC, et al. Interproximal Papilla Stability Around CAD/CAM and Stock Abutments in Anterior Regions: A 2-Year Prospective Multicenter Cohort Study. *Int J Periodontics Restorative Dent.* oct 2017;37(5):657-65.