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Selecting Implant Abutment Designs for the Successful Outcome.

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INTRODUCTION

The triumph in implant dentistry has progressed afar than just being osseointegration. The emphasis is now also on the complete outcome which includes the aesthetic and biomechanical results of the final restoration and the surrounding soft tissues. Over the last few years the persistent elevations & several alternatives in dentistry have led to the creation of different types of abutments which are better in aesthetics and functions. Such advancements mainly focuses on minimizing the operators' time, increasing the efficiency and enlarging the success rate of the prosthesis. In order to fulfil this, varieties of abutments have been launched that makes the implant restorations victorious as a whole.

The article will discuss the various implant abutment designs available, their inherent challenges and their benefits, helping the practitioner to know more about the different available abutments making it easier for a prosthodontist to be more sure about the treatments success.

METHODOLOGY

An electronic search of publications were made using electronic databases Medline & Pubmed.

Only English language articles were included in this review. A combination of the following

keywords was used: Implants, Abutments, Platform switching, Morse taper etc. All articles from

both databases were collected and duplicates deleted. In general the articles met all the

favourable criteria's and are written in English language .

ABUTMENT SELECTION

An abutment is a component, which is intermediate between the implant and the restoration and is

retained by a screw or a locking taper. The current implant systems enables the abutment to be

locked or friction fit into the implant, without using a screw or cement method of retention.

As we are apprised that the implant abutments are cement retained, screw retained, they are custom made and also are pre fabricated, abutments can be temporary & definitive too. Hereby now the question arises when is the suitable condition to choose different diversities!

The proper abutment selection is important as it provides the retention, support, stability, aesthetics and required position for the final restoration, therefore becomes the prime requisite.

The integration of the terminal restoration to the implant platform can be formulated either as a three-tier or two-tier system. Example of 3 tier system is the cement retained abutments (fig:1), whereas under 2 tier system we have single piece implants where abutment & implant acts as one, & screw retained abutment where abutment & crown acts as one (Fig:2).

These are the following types of abutments –
(i) Temporary, Definitive
(ii) Pre fabricated, Custom made.

We shall now discuss the different types of abutments available:

Temporary & Definitive abutments:

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. Permanent or definitive abutments are used for the final restoration and will remain in place definitively. The dentist has a choice during the final fabrication to use either a standard prefabricated, custom castable or computer generated abutment.

Prefabricated abutments – To use a prefabricated abutment, following parameters should be taken into account (1). **Diameter of the implant platform** as it can be narrow, regular or wide determined by the prosthodontist. (2). **The collar or cuff height** - Its the distance between the implant platform and gingival margin. (3). The interocclusal height **(Collar height)** – It determines the distance between the implant platform and the opposing dentition it should be 1.5 – 4 mm in the height and (4). It depends upon the **angulation** as well whether a straight or angled abutment is needed if angulated is required the suggestive angle is $15^0 – 30^0$.

The various designs of basic abutments available today. They are fabricated out of titanium alloys and as well as of zirconium. (5). Also an abutment can be selected with a **fixed collar height** 360^0 for posteriors or a variable collar height (lower on the facial, higher on the lingual), called an "**esthetic abutment**", for both anteriors and bicuspids. For ease of impression making, selection of an abutment with a collar height that is within 0.5mm to 1mm of the maximum cuff height measurement is obtained. This aids in the placing of retraction cord, moreover, selecting a collar height that is no greater than 1mm subgingival of the lingual-gingival height may also leave the practitioner with a finishing line that is supragingival in the esthetic buccal (facial) region. (6). However the implant abutment interface connection is described as internal or external connection and is known as '**Morse Taper'** (Fig:3) in morse taper implant abutment connection design includes a tapered projection from the implant abutment, which fits into a tapered recess in the implant. There is a friction fit and cold welding at the implant abutment interface to prevent rotation under function. Morse taper provides a hermatic seal which bacteria cannot break through leading to less microbial ingress and less bone resorption & loss. Usually a $1\text{-}2^0$ of tapered post is present which fits into mirror image shaft increasing the optimal stability. (7). "**Platform switching**" (Fig:4) is yet another term whose knowledge has proved to be beneficial, Platform switching is another concept introduced with the promise of efficiently minimizing the crestal bone loss when compared to the conventional implant-abutment junction (IAJ). It refers to the use of a smaller diameter abutment on a larger

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diameter implant collar which shifts the margin of the IAJ inward, toward the central axis of the implant. The inward movement of the implant abutment junction is believed to shift the inflammatory cell infiltrate to the central axis of the implant and away from the adjacent crestal bone, which is thought to limit crestal bone resorption , and it maintains the biological width here the suggestive platform is 5 mm, collar width of 6.5 mm & 2 mm of collar height .

Theres another variety in pre fabricated:
Screw retained abutment vs. Cement retained restorations:
The restoration of choice is screw retained when there is insufficient interocclusal space. That is the custom abutment and crown are one and the same (both are fabricated from a UCLA abutment). The use of this design, however is not limited to this situation alone. Many practitioners prefer screw retention for all of their restorations, as it allows for retrievability. When one has placed sufficient numbers of implant restorations, individual preference regarding these types of restorations are established.

The screw retained restorations provides an easy retreivabilty and are easy to repair. Whereas the cement retained are quite sound on the aesthetic grounds, they can be handled more effortlessly, and are less time devouring. But the only yet major drawback is that if the excess cement is not removed it leads to 'periimplantitis'.

Custom made abutment - Though expensive but it is used in situations where prosthetic corrections with standard prefabricated abutments are not possible. Custom abutments should be preferred: (1) if there is insufficient interocclusal restorative space, (2) if there is an angle correction problem greater than 15°, (3) if the collar height needed is more than 1 mm greater than the largest collar height offered by the implant manufacturer, (4) if there is a need to replicate the original cross-sectional profile of the tooth in order to obtain an ideal emergence profile, and importantly (5) if there is a need to splint three or more implants. In such situations customizing the implant abutment may be more advantageous as the standard stock abutments might not be able to accommodate the right changes needed.

These days a new generation of abutment construction have come up and is known as 'Computer generated abutments, using a CAD/CAM technology'. As mentioned above they are custom made definitive abutments.

This CAD/CAM technology was incorporated into the production of implant abutments and frameworks in the 1980s. These abutments are drastically altering the present restorative decorums. The long established techniques were dependant on the accuracy of the processes of impression materials, gypsum products, waxing crowns, investing and casting with alloys at high temperatures. These produced the boulevard for inaccuracies. CAD/ CAM has introduced the mechanism of fabricating the final impression with digital methods of impression making and scanning and then milling out prefabricated metal alloys to produce a restoration that is more meticulous or exact than the traditional casting methods. When considering CAD/ CAM implant abutments there are several systems available in the market currently but they all seem to stem from the following protocol: a. Scannable Abutments (Scan bodies) b. Prepable Scanned Abutments c. Virtual Assisted Design d. Robotic Analog Design Implant manufacturers have developed unique proprietary systems. Some of the common systems are outlined below:

NobelProcera® (Nobel Biocare USA, LLC, Yorba Linda, CA) provides abutments in titanium, zirconia or alumina. Fixture level impressions are made and a master cast is produced. This cast can then produce the abutment in two modes. The cast can be scanned and the abutment can be designed in an entirely 3D fashion by computer software.

Bella Tek® Endocde® (BIOMED 3i, Palm Beach Gardens, FL) is a robotic analog design. This system uses an impression of the healing abutment to design and fabricate the final abutment. These healing abutments come in a two-piece system which has notches on its occlusal surface which act as codes that the computer can scan and translate into implant abutment designs. The scanner can extract information about the position of the hex, the diameter of the implant platform, the collar height and then exact 3D placement of the implant. This then allows CAD and CAM fabrication.

Straumann® CARES® (Straumann, USA, Andover, MA) makes two-types of abutments: zirconium dioxide and titanium. In this system an implant level impression is made and the master cast is fabricated. This is called the scan model and is made in a type of plaster that is scanable. A scan body is also attached to the implant analog prior to the scan to delineate implant position. The custom abutment is then designed CAD on screen to the contours needed and transmitted to the Straumann center. Etkon is another system that uses the same principles of waxing up onto a plastic cylinder which is then removed and scanned.

Atlantis™, (DENTPSLY, International, York, PA) abutments can be fabricated in titanium or gold shaded titanium or zirconium. The gold-shaded abutments aid in covering up the silver color of the titanium and provide a more esthetic value to the patient. This system can be used with any of the available implant systems and begins with a fixture level impression and then the diagnostic cast and the master cast are scanned.

CONCLUSION
Implants have become the intrinsic facet in the present scenario in the field of dentistry & implantology. As the world is advancing so is our patients, as they too have become more enlightened and are veracious about their treatments so it is absolutely the practitioners duty to proffer with the utmost suitable procedures. So hence the understanding of abutment classification is just one step in the process of formulating the ideal restorative prosthesis. The treatment, though remains the same and will invariably necessitates correct treatment planning, decision making and sequencing of treatment that will safeguard a successful finale result.

DISCLOSURE
Any opinions expressed in this article are based on anecdotal evidence. Neither of the authors have any financial interest or are being compensated in any way by the implant companies or products mentioned.

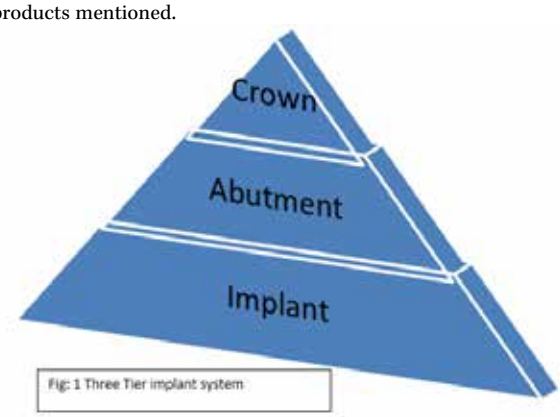
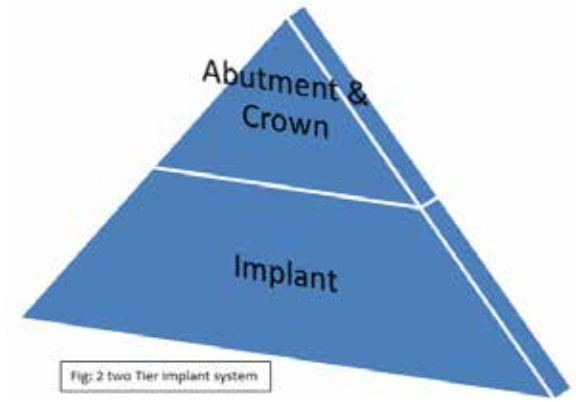


Fig: 1 Three Tier implant system



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Fig:3 Morse Taper



Fig:3 Morse Taper