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Prosthetic components of implant: A review

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ABSTRACT:

The goal of modern dentistry is to restore the patient to normal contour, function, comfort, esthetics, speech, and health by removing a disease process from a tooth or replacing teeth with a prosthesis. What makes implant dentistry unique is the ability to achieve this goal, regardless of the atrophy, disease, or injury of the stomatognathic system. However, the more teeth a patient is missing, the more challenging this task becomes. As a result of continued research, diagnostic tools, treatment planning, implant designs, advanced materials, and techniques, predictable success is now a reality for the rehabilitation of many challenging clinical situations.

Most partially and completely edentulous patients have a variety of treatment options available. It is important to first visualize the desired final prosthesis based on which, the existing bone is evaluated to determine the type and number of implants required to support the desired prosthesis.

There are various designs for the connection of prosthetic implants and abutments. They can be characterized as external and internal connection types by the position of the connection geometry relative to the body of the implant. The prosthetic connection has multiple functions. It serves as a connection between the implant and the prosthesis and is used to transmit the insertion forces required to position the implant into the osteotomy and to align the proper mating feature geometry of the prosthesis components.

1. Introduction

Dental Implantology is the term used today to describe the fixation of alloplastic materials to the jaws to support and retain prosthetic replacements for missing teeth. Currently, various modalities of treatment are available to replace missing teeth. However, the choice of modality selected for a particular patient depends on the number and factors such as status of remaining teeth, space available, adequacy of bone support, cost, and patient's desire. These treatment modalities include removable partial denture, fixed partial denture and implant supported fixed partial denture.

But nowadays dental implants have become increasingly important in oral reconstruction. The high rate of success of rehabilitation with implant-supported prostheses has increased the confidence of patients and clinicians. Research has shown that advances in implant design, materials, and technology have yielded predictable success in their application, and several types of implants are now available that can be used for rehabilitation of various clinical problems.

Restoration is accomplished using one of these basic loading protocols:

1. Conventional loading: Restoration occurs after the initial bone and soft tissue healing process, usually in 3 to 6 months, depending on bone density.
2. Immediate loading: A prosthesis is connected at the time of implant placement. This is usually a provisional restoration that is replaced with a definitive restoration after implant and soft tissue healing.
3. Early loading: The prosthesis connection occurs from 2 to 3 weeks after implant placement. This is considered to be a less predictable loading protocol because the restoration is some- times placed during the stability dip, which is the period of lowest implant stability.
4. Delayed loading: The prosthesis is connected 6 to 12 months after implant placement. This method is often chosen in poor- quality bone and in situations in which primary stability can- not be achieved during surgical placement.

Most partially and completely edentulous patients have a variety of treatment options available. It is important to first visualize the desired final prosthesis based on which, the existing bone is evaluated to determine the type and number of implants required to support the desired prosthesis.

Fixed implant restorations can be fixed with screws or cement. Screw-retained restorations allow the prosthesis to be attached directly to the implant or indirectly via a standardized abutment. For cement restorations, standardized abutments modified for specific cases or, more generally, custom abutments designed for specific cases can be used.

An overdenture attachment is a mechanical device used to provide retention between removable dentures and implants. For splint overdentures, attachments are usually incorporated into the design of the splint. For self-supporting implants, attachments often take the form of abutments that attach directly to the implant, such as ball or locator attachments.

There are various designs for the connection of prosthetic implants and abutments. They can be characterized as external and internal connection types by the position of the connection geometry relative to the body of the implant. External prosthetic connections, mostly hexagonal, place the connection outside the implant body. An implant internal connection has a connection geometry within the implant body.

The prosthetic connection has multiple functions. It serves as a connection between the implant and the prosthesis and is used to transmit the insertion forces required to position the implant into the osteotomy and to align the proper mating feature geometry of the prosthesis components. Since loads are transferred from the prosthesis to the implant at the prosthetic connection, the connection design must be strong enough to withstand all clinically relevant forces. Implant diameter and cross section and the abutment screw also have a significant effect on the overall strength of the prosthetic connection.

Another widely used connection is the conical implant connection which is deeper in the implant body and the angle at the abutment interface is smaller. A tapered connection interface area improves abutment stability, fit, and sealing performance. Caricasulo et al. reviewed the influence of implant-abutment connection to peri-implant bone loss and found that conical connections exhibited lower peri-implant bone loss in the short to medium term compared with external connections. Quaresma et al. A finite element analysis was performed on implants with internal hexagonal connections and implants with conical connections. They found that a conical connection implant connected to a solid conical internal hex abutment puts less stress on the alveolar bone and prosthesis and more stress on the abutment compared to an internal hex connection implant. Hansson used finite element analysis to study the stress distribution in the supporting bone of a conical connection implant placed at the marginal bone level. He found that the peak stress in the bone arises from axial loading at the bottom of the bone, with the tapered implant-abutment interface at the level of the marginal bone. The tapered prosthesis connection provides a stable abutment connection, reduces bone stress peaks when placed at the level of the marginal bone, and offers high resistance to axial loads.

2. Historical background

The history of implant dentistry dates back to 1980s with the development of the Branemark Protocol. The original protocol was a two-stage procedure. The first stage involved the placement of a titanium screw into the bone followed by a healing period of 3 months. Stage 2 involved the exposure of the implant and attachment of a transmucosal element. Branemark's original implant was composed of a 0.7 mm external hex with a butt joint. It was an effective torque transfer coupling device. The original hex was not an effective antirotaional device. This implant system was developed for the restoration of a completely edentulous arch with multiple implant connected to one another with a metal bar. Initially there was little interest in antirotational features of the abutment connection because implants were used to treat fully edentulous patients and were connected together with a one-piece metal substructure. The external hex portion of the implant was added to the design to enable surgical placement of the implant.Since then implant dentistry has evolved continuously and has expanded its usage in the restoration of one or few missing teeth, maxillofacial prosthetics.

Times changed and clinicians started using implants for the replacement of single teeth. This new application meant that abutment connections were subjected to an increased level of forces. This challenge has encouraged research and the development of better forms of abutment connections within the implant dentistry.

The abutment modifications that have occurred are vast and complex. For example, the external hex underwent several modifications of height and width. Besides altering the size, other modifications were also made in an effort to improve upon the original external hex design.

A major paradigm shift came with the evolution of the internal connection. Each implant company has developed their own design of the internal connection, resulting in a confusing variation in terminology and types of connections.

External hex

When an external hex implant is used to replace a single tooth, the weakest link between the implant, abutment connection, screw, and bone is the screw. This is because with this connection type the screw alone secures the abutment.

The initial 0.7 mm external connection, being short in length, provided only limited screw engagement. The original narrow platform associated with the external hex connection created a short fulcrum arm, which also increased screw loosening due to adverse tipping forces. Research clearly indicates that screw loosening is more common with external connections. The seriousness of screw loosening resulted in manufacturers implementing major modifications to the external hex connection.

The first solution to overcome the adverse force distribution and instability of the abutment connection was increasing the width and height of the external hex connection. These adjustments increased the fulcrum arm and deepened the abutment screw engagement, thus limiting the tipping forces on abutment screws and reducing the prevalence of screw loosening.

Several modifications have been made to improve upon the design of Branemark's original abutment screw. In 2000, Binon noted screw modifications that included the shank, number of threads, diameter, length, thread design, and torque applications of the abutment screw.

Other changes have focused on the material of the screw itself. Haack et al. (1995) suggested that gold screws were superior to titanium. Haack noted that, at manufacturers' torque recommendations, the mean preload using a gold screw was greater than that of titanium. Reports have shown gold alloy screws to achieve over twice the preloads of titanium alloy screws. A greater preload minimizes screw loosening.

Other designs were developed to eliminate the degree of rotational misfit. For example, 1.5 degrees of taper among hex flats was introduced, which creates a friction fit between the abutment and implant. Another design involved adding micro-stops in the corners of the abutment hexagon that engages the implant hexagon.

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Both these designs aimed to limit the misfit, which in turn limits micro-movements and screw loosening.

A variety of modifications of the external hexagon, such as the tapered hexagon, external octagon and the spline dental implant are now available.

A 1.5 degree taper to the hex flat and a corresponding close- tolerance hexagonal abutment recess that is friction fitted onto the hex. It was first introduced by SwedeVent TL (Paragon Implant Co, Encino, CA

The external octagon is an eight-sided external implant-abutment connection. Commercially, it was first marketed as a 1- piece narrow diameter (3.3 and 3.5 mm) implant (ITI Narrow Neck) The tall, octagonal extension allowed for 45-degree rotation.

The spline dental implant system (figure – 1)was developed by Calcitek (Calcitek, Carlsbad, CA) in the year 1992. The implant consists of six spline teeth that project outward from the body of the implant and fit into six grooves between the projections from the corresponding abutment. The series of opposing parallel splines match integrally with the corresponding grooves of the opposite member. External. hex and modifications of external hex are given in Figure – 1 and Table – 1.

Internal hex

To overcome the clinical complications with external implant-abutment connections, internal connection implants were developed. Dr. Gerald A Niznick designed first form of internal hex connection, which was 1.7mm deep hex below a 0.5mm wide 45 degree bevel.

The internal interface designs offer a reduced vertical height platform for restorative components, distribution of lateral loading deep within the implant, a shielded abutment screw, long internal wall engagements that create a stiff, unified body that resists joint opening, wall engagement with the implant that buffers vibration, the potential for a microbial seal, extensive flexibility and the ability to lower the restorative interface to the implant level esthetically.

6-Point Internal Hexagon Design - It has a six-sided geometric figure, that is, a hexagon recessed into the body of the implant. As the internal geometry is a hexagon, the abutment can fit over the implant at every 60 degree rotation of the implant over the abutment, but not at any other intermediate angle. It is available from Central pulse (Screw-vent) implants with a 1.2 mm length of the internal connection. This implant has evolved from the original core vent implant, with a hollow basket design to the tapered screw vent implant The internal hexagon connection is also commercially available from Friadent, Dentsply (Frialit-2). The Frialit-2 system is claimed to combine a cylindrical implant design with an internal connection. The cylindrical connection is claimed to provide lateral load resistance, resistance to joint opening, protection of abutment screw. The basic design of the Frialit-2 system is that of a stepped cylinder.

12-Point Internal Hexagon - The 12-point internal hexagon design, also marketed by some manufacturers as the offset hexagon design allows for greatest freedom of placement of the abutment over the implant. The 12-point double internal hex provides an opportunity to place the abutment on the implant for every 30 degree rotation, thus useful when we use angled abutments One such implant is marketed by 3i Implant Innovations Inc., Palm Beach Gardens, Florida, which is the Osseotite Certain.

Figure – 2

3-Point Internal Tripod - This type of implant to abutment connection represents a triangular internal geometry. This type of implant-abutment connection was introduced by Nobel Biocare, which was the replace select system. It represents the trichannel implant system. As the replace select 3-point internal tripod system offers limited options for positioning of the implant over the abutment, it is not a very clinically preferred design Camlog implant system (Alatech technologies) represents an internal tripod implant-abutment connection. The length of the internal connection is 5.4 mm. It is claimed to have a 'tube in tube effect' which is claimed to provide an accurate, mechanically secure implant to abutment connection with antirotational stability.

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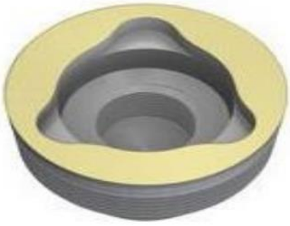

Figure – 3

Internal Octagon Implant - The internal octagonal implant represents an 8-sided internal geometry connecting the implant and the abutment allowing for positioning of the implant over the abutment at every 45 degree rotation. The internal octagon connection was introduced by Omniloc, Sulzer Calcitek. The octagonal connection, because of its thin walls, 0 to 6 mm length and a small diameter that presented a geometry profile similar to that of a circle, offered minimal rotational and lateral resistance during function.

Figure – 4

Friction fit/ Morse taper

In dentistry, the concept of this morse taper or cone screw tapered connection was first utilized by the ITI group in Switzerland. The concept of 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. This implant-abutment connection depends on this friction fit for elimination for rotation at the implant-abutment interface and subsequent abutment screw loosening. Sutter et al proposed a morse taper connection between implant and abutment as an optimal combination of predictable vertical positioning and self-locking characteristics. Studies have shown the other complications like the incidence of abutment screw loosening have also been reduced in the morse taper connection as compared to the external hex connection

The original concept of the morse taper included two tapers: 2 degree and 4 degree and is designed for a precise fit without self-locking thread.

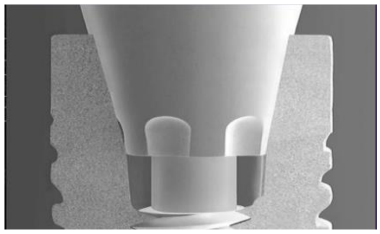

Figure – 5

8 Degree Morse Taper Implants - A further modification of the ITI-Straumann implant design is the Synocta design. Though the original implant design allowed for a precise fit between the implant and the abutment, it did not allow for rotation of the abutment over the implant and fit at a different angulation. Wiskott and Belser supplemented the morse taper connection by introducing a internal hexagon in the middle of the morse taper connection, thus allowing for repositioning of the abutment and also precise transfer of the implant position to the master cast. A new implant introduced by Osteo-Ti, known as the Combi implant has a similar mechanism of accurate positioning and friction fit like the Synocta design and combines the features of an internal hex implant and a morse taper implant. Other manufactures marketing the 8 degree morse taper implants are: Avana, 3i TG, Ankylos.

11.5 Degree Morse Taper Implant - This implant is marketed by Astra Tech. The fixture and abutment are strongly connected at an 11.5 degree angle by the conical seal design. The conical design seals off the connection and decreases micromovement and microleakage. This thread has a microthreaded conical neck and TiO blast surface. Microthreads on the fixture top prevent concentration of the stress around the alveolar ridge crest and decrease marginal bone loss.

3. 1.5 Degree Morse Taper Implants - This is a true morse taper implant with an angle of taper: 1.5 degree is available from Bicon implants. The Bicon locking taper abutment has no screw, but like a screw retained abutment, it relies on friction to keep it intact. Assembly is achieved by driving the 1.5 degree morse taper into the matching socket in the implant. A high clamping force between abutment and implant is generated by this action. The high

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friction force is the result of relative slip between the two friction surfaces occurring at high contact pressure. This results in the surface oxide layers breaking down and causing cold welding at the implant-abutment interface.

3. Methods

2.1 Cover screw

There is hole inside the dental implant with a screw thread which is sealed either by cover screw or healing abutment. With a cover screw seal, a pan head screw is inserted to completely seal the overlying gum. The advantage of this method is that the cover screw is well below the gums and is completely sealed by the gums, allowing the wound to heal without complications and minimizing the risk of infection. The drawback of this solution is that another surgical procedure (ie exposure of the implants) is required one month before the permanent denture is made. During that time the gingiva is exposed, the implant and cover screw are individually identified, unscrewed and the abutment restored. Instead, screw it in (at the base of the gingiva). Here the gingiva needs another healing period so that a precision impression can be taken from the fully healed gingival level.

Figure – 6

Cover screws are indicated in the following instances:

- Bone graft surgery, sinus lift, vertical and horizontal bone graft, in other words, where membrane, i.e. bone graft material is used and complication-free healing is all-important.
- The primary stability of the implant is inadequate with torque values less than 30 Ncm on installation.
- Smoking patients.

2.2 Healing abutment

Healing abutments, also known as healing cap or gingival formers, promote the healing of soft and hard tissue around implants. The healing cap also protects the body of the implant from plaque and debris buildup. They are often attached to implants. They are slightly wider than implants to form the gum line. Oral surgeons can use gingival formers in a one-step or two-step procedure.

Figure – 7

In a one-step procedure, the oral surgeon places the implant and healing cap simultaneously. The implant is first embedded in the bone and then a healing cap is attached. A healing abutment protrudes from the gum surface and remains in place while the dental implant heals. The healing abutments mold the gum into the desired shape for the permanent abutment and tooth replacement to have a perfect gum contour. If the gums are sutured with a gingiva former following implant surgery, 3 months later the dentist will take precision impressions of a fully healed gum surface that no longer bleeds. Once the implant and jawbone have fully fused, the healing cap is removed to access the implant. The abutment is then replaced by the healing cap. Finally, attach the crown to the abutment.

In a two-step procedure, the surgeon places the implant into the bone, then covers the implant with gum tissue and allows it to heal. After healing, the implant grows with the bone for several months in the process of osseointegration. In the second stage, another incision is made to expose the implant before the healing cap is screwed on. Gingivogenic agents help the surrounding gums heal. After a few weeks, the healing cap is removed before the abutment is installed, and finally the crown is fitted. The thorough cleaning of the healing abutments with a soft bristle brush is crucial in preventing the build-up of tartar and bacteria, the presence of which may give

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rise to inflammations which may even entail the rejection of the implant or perimplantitis.

Healing abutments are indicated in the following instances:

- The primary stability of the implant is adequate with torque values exceeding 30 Ncm on installation
- The patient does not smoke.
- No bone graft was performed on the installation of the implant.
- No provisional denture is worn at the site of the surgery.

2.3 Temporary abutment

In dentistry, a temporary abutment (also called a temporary cylinder) is an abutment used to create temporary restorations. The provisional restoration can be cemented to the provisional abutment or the provisional abutment can be incorporated into the provisional restoration for a screw-retained prosthesis. Temporary abutments are an important part of restorative dentistry. They allow the tissue around the implant to heal while providing attachment points for crowns, bridges, or other dental restorations. After the implant osseointegrates with the surrounding bone, the temporary abutment can be removed and replaced with a permanent abutment.

Temporary abutments come in a variety of designs, including: B. Snap and slim abutments provide convenient placement and easy removal. The type of temporary abutment selected for use during a dental procedure depends on the type of procedure, the patient's oral anatomy and the type of prosthesis required. Temporary abutments are plastic or metal and straight or angled. It can also be used as a diagnostic tool to assess esthetics and promote tissue healing around implants.

Clinical procedure:

1. Connect appropriate abutments and check occlusal clearance.
2. Tighten the abutment to 35 Ncm using Screwdriver Machine Multi-Unit and Manual Torque Wrench.
3. Adjust the height of the abutment post if applicable using copious irrigation.
4. Try in plastic coping and check occlusal clearance. If abutment post height has been adjusted, perform corresponding adjustment also on the plastic coping.
5. Fabricate a chair side temporary crown with usual methods.
6. Cement temporary crown. Remove any excess cement.
7. Check occlusion.

2.4 Final abutment

When your dentist installs your dental implant, the essence part that serves as a base for the crown is known as an abutment. It serves solely as a connector with one part attached to your jawbone, while the crown is fitted on the other end. Abutments are constructed with titanium, pristine sword, zirconia, gold, or polyether ether ketone. Each type of material has specific parcels. Abutment- crown complex for single- tooth restorations was first introduced in 1986. This one- piece complex was primarily composed of acrylic resin crown veneered onto prefabricated crafted titanium. latterly, for carrying better esthetics, this complex was changed to a two-piece restoration conforming of a cemented essence-ceramic crown that was supported by a prefabricated titanium abutment. subsequently, the University of California Los Angeles(UCLA) abutment was introduced in 1988, which made it possible to use custom cast essence element that can be squinched into the implant. This abutment type gained fashionability in time and still continues to be preferred for both screw- and cement- retained implant- supported restorations.

Abutments can be classified according to the connection method to the restoration, fabrication material, fabrication method, type of abutment-implant connection, and color.

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Table 1

Category	Options
Method of connection to restoration	- Screw-retained abutment-crown complex - Two-piece design with screw-retained crown over the abutment - Two-piece design with cemented crown over the abutment
Abutment connection to implant	- External connection - Internal connection
Material	- Titanium - Cast metal (noble, high noble, or base metal alloy) - Cast metal with porcelain fused at the base - Alumina - Complete zirconia - Zirconia with a titanium base (zirconia-titanium hybrid abutment)
Method of fabrication	- Prefabricated (unmodified or modified) - Customized cast abutment - Customized copy-milled abutment - Customized CAD-CAM abutment
Color	- Gold - Silver (metallic finish) - Pure white - Customized white - Customized pink/gingival shade at the cervical region

2.4.1 Implant-abutment connections

Implant-abutment connections can be classified as either external connections that protrude beyond the implant platform or internal connections that fit into access holes in the implant body.

The external hexagonal connection is still used because it accommodates two-piece implantation methods, has anti-rotation properties, and is compatible with various implant systems. The external hex also allows the ceramic to be closer to the implant-abutment interface, helping lab technicians achieve the best possible emergence profile.

Internal hex connections are often used for single piece implant prostheses. Due to its low center of rotation, it is a stable connection with high resistance to lateral forces and is also suitable for one-stage injection techniques. It also features excellent power distribution.

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2.4.2 Types of abutments

Implant-supported restorations can be divided into two types according to the type of attachment to the implant: Screw-retained and cement-retained implant restorations. A screw-retained implant restoration allows the restoration to be attached directly to an implant or abutment, whereas a cemented implant restoration uses a cement medium to hold the restoration to the abutment. The table below provides a comparison of the advantages and disadvantages of cement-retained and screw-retained techniques.

Table 2

	Screw type	Cement type
Retrievability	Restorations can be removed/replaced without damage or the need for a new restoration	It is possible if weak cements were used, i.e., soft provisional cement, otherwise restorations have to be cut in order to remove them
Interocclusal space/retention	It can also be used when the interocclusal space is limited, i.e., less than 4 mm	Minimum interocclusal space with minimum converges is needed to achieve an optimal retention
Limitation of mouth opening	The mouth opening should be enough for the use of different tools required for screwing and torquing the screws	A restricted mouth opening is less problematic than with the use of the screw-retained restorations
Occlusal loading	Unlikely to reduce the occlusal load on the restoration and the implant body	The use of soft provisional cement may reduce the occlusal load on the restoration and the implant body
Peri-implant inflammation	The adaptation between the restoration and the underlying implant is significantly better than that in the case of cement-retained counterpart	The difficulty of removing the cement and the inferiority of margin adaptation between the restoration and the abutment, when this margin is placed subgingivally can cause peri-implant soft tissue inflammation
Esthetics and occlusion	The implant needs to be placed in its optimal angulation in the anterior zone. The screw hole may interfere with the creation of an ideal occlusal morphology as well as with esthetics. The screw hole could weaken the porcelain veneer	Even if the implant angulation is not optimal, the restoration could still have good esthetics The ideal occlusal morphology can be created in the laboratory in the normal way as in the conventional restorations

Cost	The cost in terms of laboratory time and materials is much more than that for the cement-retained restorations	The materials and techniques used for the fabrication of the conventional restorations can be used in this situation

2.4.3 Abutment selection

Implant-supported single-tooth restorations require an anti-rotational abutment mechanism. Currently, the most common mechanism is a hexagon with internal connections. Due to the anatomical limitations associated with anterior single tooth implants, prosthetic abutments must be designed with an anti-rotation mechanism requiring a two-piece system. It may be necessary to use an angled abutment to compensate for implant placements that are not within the contour of the final restoration. This requires the dentist to use at least two parts.

An abutment engaging hex or anti-rotation design and an abutment screw that connects the abutment to the implant body. Abutments are basically categorized into two types according to the fabrication technique:

1. Prefabricated abutments

The prefabricated abutments are manufactured from a variety of materials by manufacturers to connect implants and restorations with different platform widths, lengths and initial gingival profiles. These abutments can be made of titanium or titanium alloys, titanium with a titanium nitride coating, or ceramic materials (alumina or zirconia). They can also be slanted or straight. Pre-angled abutments are offered in a variety of angles by the manufacturer, typically 15 and 25 degrees from the axis.

2. Custom abutments

Custom abutments are suitable for anterior restorations for aesthetics and functionality. In the posterior region, the use of custom abutments has been reported to be more successful than off-the-shelf abutments because of smaller implant diameters due to insufficient bone mass, higher masticatory forces in these regions, and wider gingiva. increase.

2.5 Casting abutment

A castable abutment, also known as the University of California at Los Angeles (UCLA) abutment are prefabricated with or without prefabricated cylinders used to fabricate custom abutments for cement-retained or screw-retained prostheses. It's a component. It is created by applying wax to a burnt-out plastic model and casting an abutment using the lost-wax method. Custom-made abutments are used to construct implants or prostheses. Such abutments can be made from a variety of materials, including metal alloys such as titanium, gold, or chromium-cobalt, or from polymers such as polyoxymethylene. During implant placement, the abutment conforms to the surrounding soft tissue while allowing height and angle correction. After final implant placement, a stable, temporary filling material is used to cover the screw access channel for easy access and adjustment if needed in the future.

Featuring a direct fit to the prosthetic platform of the implant, UCLA-type abutments can be made entirely of plastic prior to casting or have metal bands (machined) attached to the base. The casting process for UCLA-style abutments includes a lost wax process. These steps can reduce the fit of casting abutments compared to pre-machined ones.

How to use

1. Make an implant level impression
2. Lab process
3. Pour the working model
4. Seat, mark, and modify the abutment (seat the selected custom castable abutment onto the implant analog in the working model)
5. Wax the custom abutment
6. Sprue, invest and cast the abutment
7. Divest, fit, and finish the abutment
8. Apply the porcelain
9. Seat the final restoration

10. Check and modify the restoration and take radiograph along the long axis of the implant to ensure that the crown is seated completely in the hex of the implant.
11. Tighten the abutment and screw (do not exceed 20 NCM, we recommend 15-20 NCM)
12. Fill the screw and access channel

Clinical advantages

- It is easier to correct the angulation of implants
- The final restorations are manufactured to the patients exact gingival architecture, achieving an optimal emergence profile and a more esthetically pleasing outcome.
- Clinical alternative to mild or moderate implant malposition

2.6 Impression coping

There are generally two types of abutment impression copings: open tray impression copings and closed tray impression copings. Open tray impressions are considered more accurate, especially when multiple implants need to be splinted in partially or completely edentulous patients. Because of this accuracy, open trays are preferred by many dentists. There are many variations in the shape and design of implant impression copings depending on the implant system and the components designed by the manufacturer of the particular system. Therefore, you should be familiar with the design and shape of the cap to get an accurate impression.

When taking impressions of implants, the transfer technology has a decisive influence on the creation of an exactly fitting working model. In dental practice, both direct (open tray) and indirect (closed tray) techniques are often used to transfer the position of implants to the working model. Several techniques for splinting direct impression implant transfer copings have been proposed to improve accuracy. These include acrylic splints with dental floss, ready-made acrylic splints, stainless steel drill bits, and orthodontic wire for scaffolding.

With the closed tray impression technique, the impression coping remains attached to the dental implant when the impression is removed from the oral cavity. After removing the closed tray impression from the patient's mouth, the impression cap is removed from the dental implant, attached to the lab analog and reinserted into the impression.

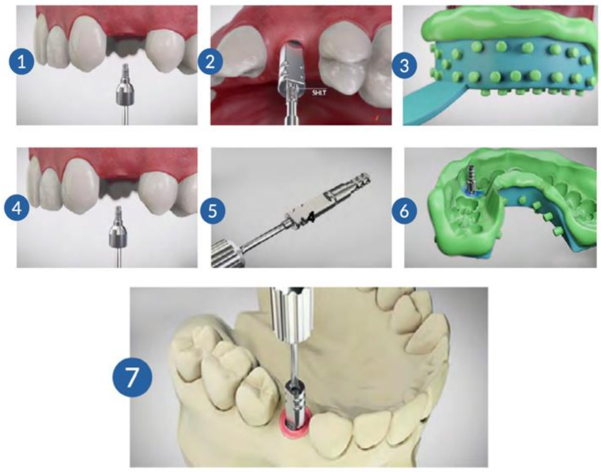

Figure – 8

1.Unscrewing of healing abutment; 2. Closed tray impression coping screwed over implant; 3. Impression; 4. Impression coping unscrewed and healing abutment screwed back; 5. Impression coping screwed with implant analog; 6. Screwed component within the impression; 7. Poured Cast with impression

With the closed tray impression technique, the impression coping remains attached to the dental implant when the impression is removed from the oral cavity. After removing the closed tray impression from the patient's mouth, the impression cap is removed from the dental implant, attached to the lab analog and reinserted into the impression.

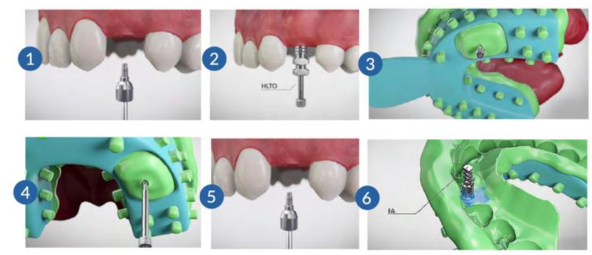

Figure – 9

1.Unscrewing of healing abutment; 2. Open tray impression coping screwed over implant; 3. Impression made and screw of impression coping is exposed; 4. Impression coping unscrewed and impression is retrieved with impression coping; 5. Healing abutment screwed back; 6. Impression coping screwed with implant analog placed within

In splint impression technique, addition of the acrylic resin around the top of the open tray impression copings is done by formation of a scaffold with dental floss to support the autopolymerizing acrylic resin. The dental floss scaffold should be in the middle third of the open tray impression coping. One end of the dental floss is secured around one of the open tray impression copings with an overhand knot. Next, a figure eight is formed around the open tray impression copings, and the scaffold is finished with a circumferential wrap. The ending portion of the dental floss is tied off with the loose end of the starting piece of floss. Autopolymerizing acrylic resin is then placed around the open tray impression copings with a paintbrush. The dental floss scaffold supports the autopolymerizing acrylic resin, which should not be in contact with the soft tissues, so that it will be surrounded by impression material when the impression is made.

Figure – 10

1. Splinted open tray impression copings in mouth.
2. Impression with splinted coping emersed within impression

2.7 Implant analog

An implant analogue is a replica of the retaining element (implant) of the restoration tooth and is used during the production of the master cast. The implant analogue is placed in the determined location and position for the final prosthesis in laboratory plaster or plaster cast. Lab analogues are replicas of implants, abutments or attachment mechanisms and are typically incorporated into casts for prosthetic reconstruction. The analog provides a replica showing the exact position of the patient's implant. This is done by taking an impression of the patient's teeth and implants and using the impression to make a copy that shows the exact anatomy of the implant in the patient's mouth. This allows the dentist to create the prosthesis and properly position the abutment. Using a lab analog can reduce errors in the placement of implants and implant-her abutments.

2.8 Multiunit abutment

The multi-unit abutment is carefully designed to rehabilitate both edentulous and partially edentulous arches, particularly when using the clinically and scientifically proven all-on-4 treatment concept.

For various soft tissue anatomies – both straight and angled 0°,17°, 30° and 45° variants are available in several different collar heights. By tilting the posterior implants, anatomical structures such as mandibular nerve, foramen mentale and the maxillary sinus are avoided and the need for bone augmentation is reduced. Tilting the posterior implants also moves the implant abutment connection to the back of the mouth. Cantilevers are therefore reduced, improving support for the prosthesis. The advantages of using multi-unit abutments is having a much easier and more predictable seating of the final restoration, creating reduced stress translated into the restorative system due to the passive nature of the seating process of multi-unit abutments.

Advantages of multi-unit abutments

1. Clinicians can determine the angulation correction needed in the patient’s mouth rather than on a model in the dental technician lab, as it was described in our case.
2. Clinicians are able to evaluate the vertical clearance that they have available. This allows them to evaluate the prosthetic options early in the process.
3. Dental technician can predictably place multi-unit analogs in the model, which will simplify lab procedures and facilitate more predictable results.

The main drawback of this particular abutment is that the screws holding the bridge are very small. The screws are small and difficult to tighten. Multi-unit abutments have a conical shape. If a cone is in line with another cone, you can create a bridge across it to keep it from swaying from side to side. This is called passive adjustment of the prosthetic bridge. If there is no alignment between multi-unit abutments, additional copings may be required to achieve better parallelism.

2.9 Overdenture abutments and attachments

The attachments can be classified into frictional, mechanical, frictional and mechanical, and magnetic attachments. The retentive force of the locator, ball, and magnetic attachments is achieved through mechanical interlocking, frictional contact, or magnetic forces of attraction between the patrices and matrices. Fabrication of attachments used to connect the denture and implants are done either by machine milling an alloy or custom cast from plastic patterns. Machine-milled attachments are usually used on the individual implant, while the use of custom cast attachments in the bar design is widely popular. Stud, Bar, Magnets, and telescopic attachments are the attachments used to retain implant overdenture.

2.9.1 Stud attachment

Stud attachments consist of a female part which is frictionally retained over the male stud. It is then incorporated into the denture resin either by transfer coping system and the creation of a master cast incorporating a replica of the attachment or directly in the mouth using self-cured or light polymerized resin

Stud attachments include:

O-rings attachment – It comprise of a titanium male unit and a rubber-ring female unit. It transfers the amount of stress to the abutments and offers an excellent shock resorbing effect during function

ERA attachment – It is an extra-radicular attachment that has two design systems. The first is a partial denture attachment, which is placed on the proximal (mesial/distal) aspects of artificial crowns, while the second is an axial (or over denture) attachment, which is either placed inside the prepared roots or the ERA implant abutment for over denture prosthesis. ERA retentive system is available in four color codes, (white, orange, and blue, gray), that offers different degrees of retention from light to heavy.

Ball attachments – The ball and socket attachments consist of a male portion, which is a metal ball screwed into the fixture, where the female part is incorporated in the fitting surface of the denture. The female part can be one of the following types:

- The O-ring, where the retentive element is rubber ring. As the rubber ring wears within a few weeks, it is better to have parallel implants.
- A metal part, as in dalbo system which permits less resilience, although the retentive forces are almost twice those obtained with the O-ring system.
- A spherical metal anchor in which the female part has a spring. These attachments are resilient and easily activated

Locator (self-aligning) attachment – It is an attachment system with self-aligning feature and dual retention; inner and outer Locator attachments are available in different colors (white, pink and blue), each having different retentive value. Additional features include the extended range attachments, used to correct implant angulation up to 20 degrees. They are available in green, which has standard retention, and red, which has extra-light retention. The reduced height of this attachment is an advantage, especially for cases with limited interocclusal space or when retrofitting an existing old denture

Magnetic attachments – In the magnet system used for overdenture retention, the magnet is incorporated into the overdenture, which is a neodymium-iron-boron alloy or a cobalt-samarium alloy. The ferromagnetic keeper is the second part of the magnetic system, which is screwed into the implants.

2.9.2 Bar attachments

The bar attachment usually includes a metallic bar, that splints two or more implants or natural teeth spanning the edentulous ridge between them and a sleeve (supras-tructure) which is incorporated in the overdenture that clips over the original bar to retain the denture. A wide

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variety of forms of bar attachments are available; they could be either prefabricated or custom made. Based on the shape and the action performed, they are of two types: single sleeve and multiple sleeves; the former has to run straight without allowing the anteroposterior curvature of the arch, so it is used in square arches, while the latter can follow the curvature of the arch and also enables the use of more than one clip.

4. Discussion

An osseointegrated implant that is prepared for prosthetic restoration usually results from a successful surgical placement and appropriate healing. Modern dental implants are internally threaded, enabling the restorative practitioner to create a restorative platform from second-stage prosthetic components. Implant restorations need the utilization of multiple constituent elements. The sheer quantity of components and each patient's individualized restorative need can be daunting for a novice implant doctor. The general description of the parts commonly utilized in dental implant restorations is provided in this section. It should be mentioned that although the names of the components in an implant system made by one manufacturer may not match those of another, the concepts behind them are the same.

Clinical variability is a defining characteristic of implant dentistry. There appears to be an endless variety of therapeutic circumstances. The patient is usually desperate and seeks implantation as a final resort. Patients often come in seeking more complex restoration options after their attempts at dental rehabilitation have failed. Many patients arrive having lost a significant amount of bone density over many years, making it impossible for them to wear traditional dentures. Patients who have experienced trauma or who have developmental or craniofacial abnormalities also have complex prosthetic demands. Examples of some of the most difficult clinical scenarios are shown in the next section, along with information on how oral-maxillofacial surgeons can continue to support restorative dentists in providing implant dentistry for patients.

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