The passive abutment

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One of the main problems faced by both prosthodontists and dental technicians, with regards to implant supported dental prostheses is the problem of producing a repeatable passive fit which would eliminate the need for complex and intense laboratory procedures, usually undertaken to improve the fit of castings e.g. sectioning and soldering.

The Passive Abutment (Fig. 1) is unique to Southern Implants and has been in clinical use since 1998. It allows one to achieve a predictable passive fit of cast structures in a practical way.

The unsatisfactory fit of prosthodontic work on implants is due not only to the distortion caused by the physical process of investing, casting and sandblasting, but also from the distorting forces which develop when the casting is exposed to repeated high temperature cycles while baking porcelain. All these parameters cause the collection and entrapment of energy resulting in tensions, which are then transferred to the prosthetic screws. Consequently we have fractures of screws, destruction of the prosthesis (porcelain fracturing) and perimplantitis. Finally there is breakdown of relationship between the patient and the dental practitioner and tension among members of the implantology team as well (technician/dentist/prosthodontist/surgeon).

After years of research by Southern Implants, the first prosthetic abutment with a passive fit was presented to the dental implant market in 1994.

The philosophy of the passive abutment is innovative in the field of dental implantology and has reduced the stress experienced by the technician and the dentist, especially when it comes to the fit of the prosthesis.

By reviewing data from x-rays of patients who have dental implants with fixed prostheses, one can see marked differences between those with passive abutments and those without.

Passive fit is achieved by luting a pre-machined titanium interface component onto the finished prosthesis, using the laboratory master model as the blueprint for fit. The luting takes place in the dental lab by the dental technician. No additional clinical steps are required.

The discrepancy between the passive ring and implant reaches as low as 2 microns, independent of the length of the span of the bridge. The titanium interface component is kept separate from the manufacturing of the casting and is therefore not subjected to degradation by heat cycles or devesting and finishing procedures as a cast-to-gold cylinder would. The integrity of the machined part is therefore maintained in the original condition.

The passive abutment kit includes a titanium ring, which will not be subject to external physical forces and is cemented to the porcelain superstructure after the aforementioned is cast and polished.

Description

The Passive Abutment consists of four components (Fig. 2)

1. Plastic cylinder - this component is incorporated into the wax-up of the structure and thus becomes part of the casting.
2. Titanium interfacial component (6 mm) - this pre-machined component forms the final interface between the casting and the implant.
3. Luting screw - this small screw is used to clamp the interfacial component onto the laboratory analogue during the process of luting the casting onto the interfacial component.
4. Prosthetic screw - this screw retains the completed prosthesis to the implant at final placement and provides a compressive force across the cement line.

Overview of use

The plastic cylinder is incorporated into the wax-up and becomes part of the cast structure. The casting may then undergo further laboratory processing e.g. ceramic firing, finishing and polishing before being assembled with the interfacial component. The titanium interfacial component is kept separate from the manufacturing of the casting and is therefore not subject to degradation by heat cycles or de-vesting and finishing procedures as a 'cast to gold' cylinder would.

The integrity of the machined part is therefore maintained in its original condition.

The finished cast structure is assembled with the interfacial ring by luting before placement in the patient’s mouth by the dental technician. Both titanium ring as well as the prosthesis, need to be sandblasted and cleaned by air pressure and not with a ultrasonic bath.

For assembly, the titanium interfacial component is clamped to the analogue on the master model by means of the luting screw. The luting screw ensures that the interfacial component is held in full contact with the implant analogue.

The finished prosthesis is then luted to the clamped interfacial ring using a dual-cured resin cement.

In this way the resin cement serves as a space filler between the casting and the interfacial ring, thus compensating for any minor casting and finishing discrepancies, so eliminating misfit of the casting to the implant. At placement in the mouth, the prosthetic screw retains the completed prosthesis (both casting and interfacial ring together) to the implant and maintains a compressive force over the cement line. This is achieved because the prosthetic screw engages onto the casting and not onto the interfacial ring. The cement is therefore not responsible for retention of the prosthesis, but is merely a space filler.

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some implant cases. Problems of Conventional Cast Structures Frameworks incorporating cast to gold cylinders are very commonly used in implant reconstruction, as are castings fabricated using plastic burn-out cylinders. These castings however are subject to signifi- cant difficulties. Significant de- terioration of the fitting surface of the cast structure occurs as a result of laboratory procedures (Fig. 5) - sandblasting of the casting - the casting is subjected to re- peated high temperature cycles during casting and porcelain fitting procedures. This results in oxidation of the fitting surfaces and further deterioration of fit. - the gold fitting surface is deterio- rated by multiple “fittings” on the model, especially if the al- onges are not kept clean. The larger and more complex the casting, the greater the like- ly degree of discrepancy of fit. Hence, larger castings with fit discrepancies are often cut and soldered, or laser-welded. It is commonly reported that these attempts to improve the fit result in even greater fitting problems and may be amplified by porece- lain fitting.

Clinical implications of misfitting implant structures Discrepancies in fit are extremely difficult to detect clini- cally, if not impossible where the interface between implant and superstructure is subgingi- val. Vertical misfits will only be detected on x-ray, if the misfit occurs interproximally and the x-ray beams is orientated perpen- dicular to the interface. If the discrepancy is in the bucc- lingual plane, it will not be detected on x-ray. Even gross discrepancies may be missed where x-ray techni- ques are not optimal (Fig. 4). Most importantly, poorly fitting prostheses can result in: -bacterial accumulation at the prosthetic/implant interface, which will result in bone loss around the implants (Fig.5) -mechanical strain being ap- plied to the implant, which may result in bone loss - poor preload of retaining screws and thus more frequent screw loosening - damage to the interfacial component of the retaining screws, resulting in screw frac- turing.

The Laboratory Procedure 1. Model preparation: The appropriate analogues must be selected and the model pre- pared using a silicone or rubber soft tissue mask. The highly recommended use of a remov- able soft tissue mask will allow easy access to the analogues for further lab procedures and will greatly ease later assembly pro- cedures.

2. Wax-up: The Titanium Ring and Waxing Sleeve are assembled on each implant analogue, using the brass equivalent of the prosthet- ic screw to hold them in place (Fig.6). Do not over tighten, so as to avoid distortion of the plast- ic ring. The wax-up can be cut back or added to as needed.

The wax-up is completed and sprued before removing the wax-up from the model.

3. Investing and Casting: The retaining screw must be removed to allow the wax-up to be cast with plastic cylinders to be lifted from the model, leaving behind the loose titanium interfacial component (Fig.7). Standard procedures are used for invest- ing and casting. An appropriate casting alloy must be chosen, depending on whether a ceramic veneered bridge or cast bar is required (Fig.8).

Once resin cement has hardened, remove all luting screws and then remove any prosthetic retaining screws so that the prosthesis can be lifted from the model (Fig. 11). Attach polishing protectors or implant lab analogues, of cor- rect diameter to each of the fitting surfaces of the cemented titanium rings. Remove excess resin cement from the model by using a sharp blade, probe or hand scal- cer. Polish the remaining cement to the fitting surface of the cast- ing until it is smooth, polished, and superstructure is subgingival. The Passive Abutment is intended to harden. (e.g. use the middle temper to achieve a hardness of about 800°C for at least 45 minutes. As with all implant work, it is best to de-invest ultrasonically as opposed to blasting with sand or glass beads. This helps pre- serve the sharp edges and fitting surfaces of the casting.

4. Refining the screw seat: The “wedge” is a piece of the internal ledge in the casting where the head of the screw will seat (en- gage). The cast surface of the screw seat will likely be rough due to the casting procedure and must therefore be refined using special hand-held reamers (Fig. 10).
implant using a syringe with a blunt delivery tip.

c. Place the loose Passive rings individually into position on the implants and press the down into place using a flat-ended “plastic” instrument. When the rings are seated, the gel helps hold them in place. The soft tissue surrounding the rings also holds them in place quite well.
d. Place the metal structure over the rings in the mouth, taking care to align the casting properly so as to not disturb the rings.
e. Screw retain the structure by placing a few prosthetic screws in strategic places.
f. When removing the frame, take care of any rings that may drop. Some rings may be left on the removed frame while others may be left on the implants. Count the rings to make sure you have all of them.

It is an advantage of the Passive system that the fitting surfaces can be removed from the casting to avoid damage by heat cycles during the repair process and then be refitted.

Delivery of the Final Prosthesis

Once the final prosthesis is placed into the patient’s mouth, peri-apical X-rays should be taken in order to verify the positive fit onto the implants. The X-ray beam should be oriented perpendicular to the implant/prosthesis interface in order to increase the chances of detecting a potential discrepancy (miss fit).

Eliminating a Miss Fit

In case that a miss fit is detected, make sure that no soft or hard tissues are interfering with the positive sitting of the prosthesis. As mentioned above Passive Abutments can eliminate all discrepancies introduced into the prosthesis during the laboratory steps of the manufacturing.

If a miss fit is detected, this is attributed to one of the following reasons:
a. distorted implant impression
b. increased implant component tolerance
c. distorted plaster implant model

In order to eliminate a miss fit, a new implant impression should be taken and a new plaster implant model should be poured again. The laboratory technician is going to use the new implant model as a blueprint in order to recement the passive abutments (Fig. 15).

As a result of these actions the new radiographic examination should reveal no discrepancies to the fitting of the prosthesis onto the implants.

Conclusion

The Passive Abutment from Southern Implants allows one to achieve a predictable passive fit of cast structures in a practical way. It’s easy to use, cost effective and has repeatable results, which eliminate the need for complex and intense laboratory procedures like sectioning and soldering.