Clinical Protocols for the Simplified Application of Implant Angled Access Abutments

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Abstract

Angulated dental implant abutments are now relatively commonplace in the prosthetic reconstruction of patients requiring implant treatment. They are most commonly applied in multiple implant screw retained full arch cases and the ability to alter the alignment of the implant fixture gives the opportunity to optimize the path of insertion of the prosthesis and locate access screw holes in an aesthetically and occlusally favorable position. This paper reports on two clinical cases utilizing a novel jig and abutment system to optimize accuracy in the passive seating of the overall prosthesis.

KEY WORDS: Dental implants, abutment, prosthetics, aesthetics

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INTRODUCTION

Today’s complex dental implant supported restorations require treatment protocols based on a multitude of diagnostic information. Typically this is collected from clinical examination, radiographs, diagnostic casts and jaw relation records. Functional wax-ups, esthetic wax-ups, and computer imaging often add supplementary information. Provisional and final implant-supported prostheses are typically designed to create a harmonious and functional occlusion, good phonetics, effective oral hygiene and a pleasing esthetic outcome.

Critical to our ability to successfully fabricate a complex implant supported esthetic prosthesis is the surgical precision in the placement of dental implants as they relate to the final prosthesis. Unfortunately, even with our best attempts to insert implants in anatomical positions which would permit laboratory fabrication of the proposed restoration according to an “ideal” functional and esthetic design, it is often necessary to accept compromises to avoid adjacent or nearby anatomical structures. Examples include insufficient bone volume, proximity of the mental foramen or inferior dental canal or location of the maxillary sinus.

As a result, this “less-than-favorable” implant insertion position can initiate compromises in the design of the final restoration with respect to the desired esthetic final tooth positions as well as the occlusal scheme. Screw retained prostheses are especially vulnerable to undesirable implant angulations since the acrylic or ceramic materials may be placed at increased risk of fracture. A screw access hole at a cusp tip or on the facial surface and incisal edge creates difficulty in achieving an aesthetic or functional result.

Angulated dental implant abutments are now relatively commonplace in the prosthetic reconstruction of patients requiring implant treatment. A number of studies\(^1,2\) have reported comparable success rates between the use of angulated abutments and standard abutments in reconstruction. Parameters measured in these studies included probing depths, gingival level, gingival index, mobility and survival and no significant differences were found in parameters or survival between the use of standard and angled abutments. Angled abutments are probably most appropriately applied in multiple implant screw retained full arch cases. The ability to alter the alignment of the implant fixture gives the opportunity to optimize the path of insertion of the prosthesis and locate access screw holes in an aesthetically and occlusally favorable position. One of the challenges of working with angled abutments however, is the appropriate orientation and placement.
of all abutments at the time when the prosthesis is seated and fitted. Coward & Watson suggested a simple laboratory made acrylic guide to aid seating and accurate recording of an impression. Dixon & Breeding went on to describe a surgical guide to assist fabrication and placement. It would seem that transfer indexes are useful in accurately transferring the ideal position of several abutments from the master cast to the mouth in a predictable way. Nicholson describes such a method for 17° angulated abutments. Such abutments have now been refined in design and offer a range of angulations (10°, 20° and 30°) and are more compact needing less occlusal clearance (5mm) and have larger retention screws (Neoss Access Abutment, Harrogate, UK). Sorrentino et al. has discussed the dimensional accuracy of implant impressions in relation to the affect of implant angulation, length and material and reported that significant angulation of implants may cause strain and distortion of impressions related to their wider divergence on impression removal. It is therefore very important to have a standardized technique which minimizes the introduction of such possible errors. This paper reports on two clinical cases utilizing a novel jig and abutment system to optimize accuracy in the passive seating of the overall prosthesis.

The Neoss Access Abutment (Neoss Limited, Harrogate, UK) offers a low profile, high precision internal implant connection with 0, 10, 20 and 30 degree angulations, and fits Neoss implant diameters of 3.5-5.5mm. Figures 1a & b show a 10° Access Abutment with its internal prosthetic housing. Figure 1c shows the angled abutment fully seated into the Neoss dental implant. A plastic carrier was used to transfer the Access Abutment to the implant, with the driver engaged into the prosthetic screw.
CASE REPORTS

Case 1
An 82 year old male presented with a chief complaint of missing most of his upper and lower teeth, and an inability to chew most of his foods. His past medical history was significant for a hip replacement and he was taking Fosamax and Allopurinol. The patient expressed a desire to have his mouth restored, and preferred to have fixed prostheses supported by dental implants if possible.

A complete clinical examination was performed, x-rays and clinical photographs taken, and impressions recorded for study casts. Custom acrylic trays (Orthodontic resin-Caulk Dentsply, Milford, DE) were fabricated and on the second visit additional impressions were taken. A face-bow registration was recorded, and wax-occlusion rims were fabricated to mount the master casts on an adjustable articulator (Stratos 300, Ivoclar Vivadent).

Diagnostic tooth set-ups were performed by the dental laboratory (Marotta Dental Studios, Farmingdale, NY), and evaluated in the patients mouth. Lip line, speech, freeway space and occlusion were meticulously evaluated. The patient subsequently had a CT-scan of his maxilla and mandible to evaluate bone volume for dental implant placement. The dental laboratory subsequently fabricated a provisional maxillary complete denture, as well as a provisional mandibular acrylic bridge with a lingual Rexillium frame for immediate provisionalization following the extraction of his remaining teeth and implant insertion. This paper focuses on the restoration of his maxillary arch, which required implant angulation correction at the prosthetic component level.

After the healing period of approximately six months (Fig. 2), a closed tray full arch impression (Express™ STD, 3M ESPE, Seefeld-Germany) was taken using Neoss impression copings. The master cast was then verified radiographically with an acrylic splint (GC America Inc., Alsip, IL).

The preferred restoration of choice was a screw-retained full arch cast metal frame “hybrid” prosthesis. Critical to the esthetic tooth requirements in the anterior region and the integrity of the occlusal surface anatomy of the posterior acrylic teeth is the optimal placement of the screw access holes. A laboratory surveyor analysis of the master implant fixture-level cast using a clear vacuform stent which was fabricated over a stone cast of the desired tooth set-up revealed implant angulations which would result in screw access holes positioned too far labially to fulfill the esthetic and functional requirements for this prosthesis (Fig. 3). Impression screws were...
seated into position and they emerge through the clear vacuform labial to the tooth surfaces revealing excessive labial inclinations of implants in positions #6, 7, 10, 13 and 14. Angled Neoss Access Abutments were therefore selected to provide angled correction of the screw access holes lingually to more favorable anatomical positions according to the desired prosthetic tooth set-up.

Neoss Access angled abutments were utilized in 10° and 20° angulations. The Access abutments are packaged with a plastic tab “carrier” which via a frictional internal seat, is used to transfer the angled abutment to the master cast and mouth for seating within the implant’s internal connection. Once it is stabilized, the Access Abutment screw is tightened and torqued to 30Ncm. Of particular importance in the design of the Access Abutment is the single platform concept of the Neoss implant system. This facilitates a simpler selection of machined components as compared to implant systems with multiple platform dimensions.

To further facilitate the seating of multiple Access Abutments intra-orally in their correct orientations, which were determined by the prosthetic dental laboratory, a positioning device was fabricated. This is essentially a verification positioning resin-based splint which rigidly connects each seated Access Abutment’s plastic carrier to each other on the master implant cast. Resin (GC America Inc., Alsip, IL) is applied to each plastic Access Abutment carrier, and bridged together as a single verifiable positioning component. This permits the clinician to lift off and carry multiple angled abutments and simultaneously insert them correctly in the mouth (Figs. 4a & b). Figure 4c shows the resin positioning device after it is disengaged from the seated Access Abutments.

Once the Access Abutment positioning device is transferred to the mouth, and each Access Abutment is positioned inside the respective implant internal connection, the
screw tightening procedure commences. The Access Abutment is designed to engage the walls of the implant’s internal connection and fully seat only when its screw is completely tightened. If the clinician sequentially attempts to completely tighten one Access Abutment in the positioning device at a time, it may disengage from its splinted plastic carrier, creating the potential for rotation and thus an incorrectly seated position. This is especially significant in situations where the Access Abutment seats to a deeper subgingival position, making visualization of its orientation difficult. The proper clinical protocol therefore is to engage the driver

*Figure 4a:* Resin transfer jig to permit accurate transport and seating of abutments.

*Figure 4b:* Resin transfer jig to permit accurate transport and seating of abutments.

*Figure 4c:* Resin transfer jig to permit accurate transport and seating of abutments.

*Figure 4d:* Resin transfer jig to permit accurate transport and seating of abutments.

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into each Access Abutment screw and turn only approximately 180 degrees at a time for each angled abutment, repeating sequentially for each Access Abutment that is connected to the verification positioning device, until each abutment is completely seated. This will ensure that each angled abutment does not separate from its plastic carrier, as they are inserted.

The removal process is simply the reverse of the insertion sequence. The driver tool is sequentially rotated counter-clockwise 180 degrees at a time, for each Access Abutment that is connected to the resin positioning device. This is necessary to ensure that the angled abutments remain attached to their respective plastic carriers when, for example they are removed from the master implant cast to transfer to the mouth.

Neoss Access Abutments were selected by the dental laboratory based on the amount of angled correction necessary. Figure 5 illustrates the resin positioning device with six Access Abutments secured in place in the maxillary arch. Figure 6 shows the Access Abutments in their final positions, which will permit the dental laboratory to fabricate the final prosthesis with all screw access holes correctly positioned.

After the Neoss Angled Abutments were fully seated, the screws were torqued accord-
ing to the manufacturer’s specifications to 30 Ncm. The framework with tooth set-up was secured into position over the Access Abutments and passive seating verified using x-ray confirmation and a Sheffield test.

At this point the framework with tooth set-up in wax was removed and the laboratory resin positioning device repositioned to remove and return the Access Abutments to the master cast. Sequential 180 degree counter-clockwise rotation of the torque wrench is again necessary to ensure that each angled abutment does not separate from the retentive placement tool, each of which is attached to the resin positioning device. The laboratory will complete the processing of the screw-retained prosthesis, which will be delivered over the secured Access Abutments. The final framework screw access holes are now well positioned on both the occlusal and lingual surfaces, thereby permitting maximum esthetics without compromise to the structural integrity of the individual resin teeth (Fig. 7). The final prosthetic screw is subsequently torqued to 20 Ncm, and the access holes closed with rolled Teflon (PTFE) white tape and composite resin. Figure 8 shows the final implant supported screw-retained prosthesis.

Case 2
Case No. 2 is that of an eighty year old female who presented with a chief complaint of missing her maxillary “back teeth”, and an inability to chew foods well (Fig. 9). Her past medical history was significant for controlled hypertension, and well controlled diabetes Type II. The patient went through the same protocol of diagnostic casts, occlusion rim fabrication for centric jaw relation records, esthetic and functional maxillary arch tooth set-up, and a CT-scan.

Since a flange was not required for lip support on this patient, the preferred restoration of choice was a screw-retained full arch porcelain-fused-to-metal bridge. An acrylic full arch laboratory provisional bridge “shell” with a Rexilium lingual frame was fabricated using the trial tooth set-up as a guide. Eight Neoss implants were placed at surgery in tooth positions #3, 4, 5, 6, 11, 12, 13, & 14, and a closed-tray fixture-level impression was taken for next
day laboratory processing of her provisional acrylic bridge, supported by eight titanium temporary implant abutments (Fig. 10 & 11).

The dental laboratory determined that implants in tooth positions #6 and #14 would require angulation corrections to the screw access positions for both the provisional and final prostheses. Therefore, Neoss Access Abutments of 20° angulation were selected for each position and inserted at the time of provisionalization. Two separate positioning jigs were fabricated by connecting each Access Abutment’s plastic carrier to an adjacent impression coping with resin (GC America Inc., Alsip, IL), after it was fully seated into the stone cast analog (Fig. 12). This provides a simple and effective means of transferring the Access Abutment to the mouth to prevent the possibility of rotation. Both the impression coping screw and Access Abutment screws were tightened approximately 360° at a time, in a sequential manner, thereby allowing the angled abutment
to fully seat within the implant’s internal housing simultaneously as the impression coping screw is also fully tightened. This again will prevent separation of Access Abutment from the plastic carrier prior to being fully seated.

The laboratory processes the provisional restoration using specific titanium Access provisional abutments for tooth positions #6 & 14, while the other six implants were loaded with Neoss titanium temporary implant abutments. Figure 13 shows the provisional acrylic restoration in place one week post-surgery.

After a healing period of 5 months, when the gingival tissues have reached their final healthy contours (Fig. 14), an open-tray full arch impression was taken to create the master implant cast (Figs. 15 & 16). Neoss Access Abutment impression copings were used for both seated Access Abutments, and implant fixture level impression copings were used for all other implants.

The master implant cast was verified radiographically, and then mounted on a Stratus 300 articulator for fabrication of the metal framework. An index of the provisional acrylic bridge was recorded intraorally and positioned on the master cast as a means of evaluating final tooth position and contours (Fig. 17.) Also note that this Figure shows the Neoss Access Abutments seated in the master cast in tooth positions #6 and 14.

After try-in and verification of a passive seat of the metal framework (Fig. 18.), the laboratory completed the porcelain application for final insertion (Fig. 19). The Access Abutment
Figure 15a: Resin impression jig.

Figure 15b: Resin impression jig.

Figure 16a: Impression tray and impression.

Figure 16b: Impression tray and impression.

Figure 17: Tooth position index from provisional.
screws were torqued according to the manufacturer to 30ncm and the direct-to-fixture screws were torqued to 35ncm. The screw access holes were subsequently closed with rolled Teflon white tape and composite resin. Figure 20 shows the completed esthetic screw-retained prosthesis.

**CONCLUSION**

The Neoss Access Abutment is a low profile component offered in 0°, 10°, 20°, and 30° of angulation with as little of 4.5 of interocclusal space. Its clinical application permits a simplified approach for the correction of dental implant angulations which can otherwise compromise the esthetic and functional results of the final prosthesis. While
Angled abutments are not suited for every situation, especially when superficial implant heads co-exist with a high smile lip line anteriorly, they significantly ease the burden of relying on ideal implant placement in the presence of anatomical restrictions, as well as the need for costly and often bulky sub-frames as a means of coping with unfavorably located access holes in screw-retained prostheses.

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References

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