# A Prosthodontic Technique to Improve the Simplicity and the Efficacy of Angled Abutments for Divergent Implant Situations: A Technical Note

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*Esthetic demands and nonparallel situations between the axial direction of the suprastructure and the implant require angulation of the abutment. The Conical Seal design avoids microleakage and micromovements after the abutment has been seated and finally retained via screw. However, there is no protection against rotation during the fixation procedure. Therefore, a control device and/or method for a reproduction of correct seating during each treatment step of permanent prosthesis fabrication is desirable. The purpose of this investigation was to develop a device to ensure the correct seating by less expensive, safer, easier, and more precise methods. The sequence of components and the standard procedure required modification: in the modified procedure, the impression is made at the implant level, and the straight implant replica is embedded in the laboratory cast. The angled abutment needs modification by grinding to create small margins in the mesial, distal, and palatal walls. Three materials that are used in daily dental practice are combined to fabricate an individual transfer device. Direct waxup of the restoration onto the angled abutment without a prefabricated component shortens the laboratory processing. The modified sequence and procedure, small alterations of the angled abutment, and an individual transfer device can simplify the transfer procedures, improve clinical performance and applicability, and shorten chair time.* (Technical Note) INT J ORAL MAXILLOFAC IMPLANTS 2006;21:320–324

**Key words:** *angled abutment modification, individual transfer devices, prosthetic procedures, prosthodontic axes*

As an implant-abutment connection can be continuously rotatable, its exact position needs to be defined, confirmed, and transferred from the master cast to the mouth by a quick and safe procedure. The oral situation needs to be reproduced exactly for laboratory processing, especially if a modified angled abutment is to be used.[1,2]

A literature review using Medline led to 51 publications concerning Astra Tech implants (Lexington, MA). Only 16 of these took into consideration the fact that that the restoration would be fixed on the implants.[3,4] Unfortunately, there is lack of practical advice related to the clinical procedure (for example, how to make and use a transfer device). Often, product guideline sheets provided by the manufacturers are the only information available to the dentist. According to such information sheets, an indexing feature is necessary, but no precise description can be found concerning how to fabricate and use it. User guidelines for screw-retained fixed restorations provide some information about the shape of a transfer device.[5]

The available data sheets for the Astra Tech angled abutment do not mention customized transfer keys, as the existing indexing feature is considered to be sufficient using a different method: usual positioning of the abutment with the ground-down index in the mouth and transfer of this position by impression to the master cast. The angled abutment has no margin, a height of only 5.1 mm, and a large central opening (diameter 2.4 mm) for the screw. Unfortunately, it is too short and too thin to be short-

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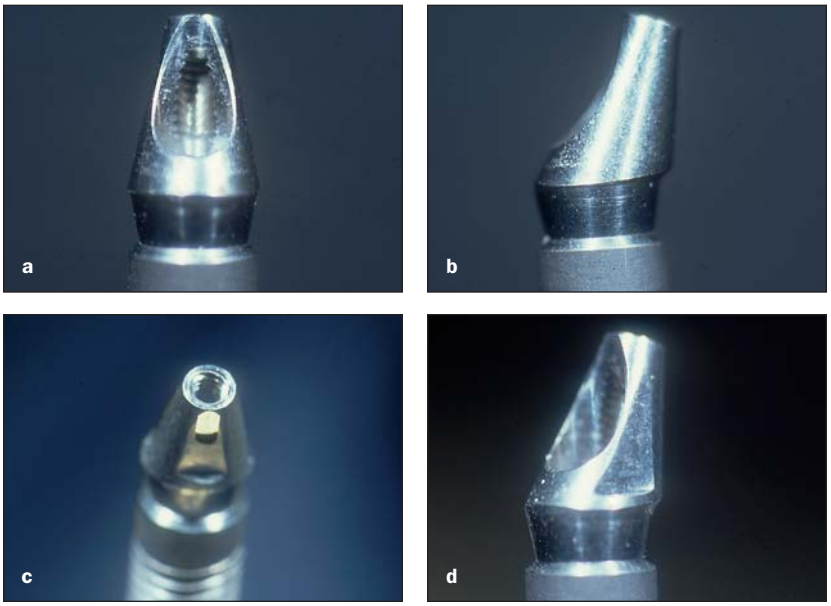


**Fig 1a** The original angled abutment from the labial aspect with the hole for the abutment screw. The conical angle is 20 degrees. The top cone has a height of 5.1 mm, and the diameter of the screw hole is 2.4 mm. The central abutment screw is fixed in the implant with a maximum of 4 turns.

**Fig 1b** Lateral view. The concave hole for the abutment screw, caused by drilling with a round bur, can be seen. The conical shape is tangential, without a defined margin.

**Fig 1c** Occlusal view. The opening for the screw is visible, with a remaining wall thickness of about 0.6 mm. The palatal slice cut with its cervical margin has been finished.

**Fig 1d** The modified angled abutment from both the lateral and labial aspects. The labial angle has been enlarged so that the axial walls of the screw channel changed from concave to linear. The depth of the slices on both proximal sides is about 0.4 mm. The instrument for the lateral slice cut is a hard rubber wheel designed for steel polishing.

ened any further because of decreasing retention of the crown and the screw thread. Its angulation is 20 degrees. Therefore, the goal of this investigation was to develop and to present a technique for making and using a transfer device for the Astra Tech angled abutment.

## MATERIALS AND METHODS

The usual treatment procedure needs to be basically altered. After the implant is uncovered, a healing abutment is connected and must not be changed at any time during the procedure. The impression can be made from the implant level with a closed or open tray method. The straight implant replica can be used for the master cast (Figs 1a and 1b).

The technician must modify this abutment by individual preparation because of its round and conical shape and the missing margin. The angled abutment design can be altered from the long axis of the implant in 3 steps:

- First, the abutment is rotated into the most suitable position. It must be retained by its screw.
- The labial side of the abutment is prepared to create flat, non-concave medial and distal walls. Thus, a precise seat of the transfer device can be achieved.
- Small slices with a hard rubber wheel into the medial, distal, and palatal wall create a cervical margin of about 0.4 mm depth (Figs 1c and 1d).

Subsequently, an individual transfer device is necessary. As the connection between the abutment and the implant can be rotated, the exact position needs to be found and confirmed. Then, the perforated abutment must be prepared to ensure the right position relative to the transfer device for its control.

The alteration process is followed by making an individual plastic device to guarantee the right position and the quick and safe transfer from the master cast to the mouth. Different materials are used. Initially, the impression needs to be covered where the implant is situated with a layer of about 2 to 4 mm of cartridge-provided silicone (Gingifast; Zhermack, Badia Polesine, Italy). After curing, the plaster cast can be made. The hole for the screw has to be blocked out (Special Wax; Austenal, Cologne, Germany) (Fig 2). Following, the plaster is isolated using Aislar (Heraeus-Kulzer, Wehrheim, Germany) or Ivoclar separating fluid (Ivoclar, Schaan, Lichtenstein).

A hard and stable scaffold made of the white composite Spectra Tray (Ivoclar) can be applied both around the abutments and on the adjacent teeth and is manually preformed. After light curing for 90 seconds, the material can be trimmed and finished with about 1 mm of relief provided around the abutment (Figs 3 and 4a). The Opaquer fluid of the Dentacolor System (Heraeus-Kulzer) serves as a bonding agent to the next material (Fig 4b).

A dispenser provides a low-viscosity light-curing acrylic resin with very low shrinkage rates (Sinfony; 3M ESPE, Seefeld, Germany) which is applied in 3 to 5 layers around the abutment. Each layer must be light

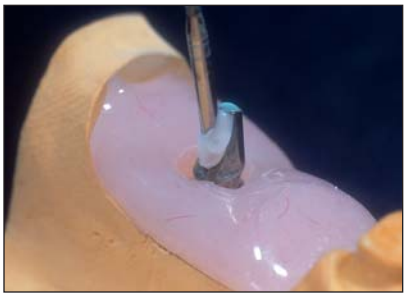

**Fig 2** The suprastructure insertion direction has been parallelized to the vertical axis of the mesial crown. The gingival mask Gingifast (Zhermack) is a removable artificial substitute for bone and gingiva on the isolated plaster model. A hex screwdriver indicates the long axis of the implant, and the Special Wax blocks out the cavity of the abutment.

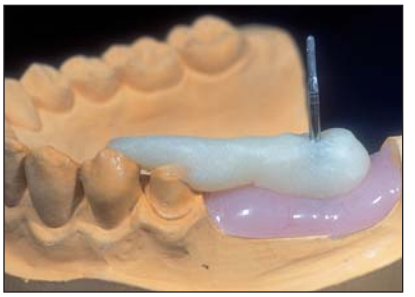

**Fig 3** The transfer device from the buccal aspect. The composite Spectra Tray has been put on the gingiva mask around the abutment and adapted manually.

**Fig 4a** Around the top of the abutment about 1.0 mm relief must be drilled out for the corrective acrylate. The gingival mask has been taken away.

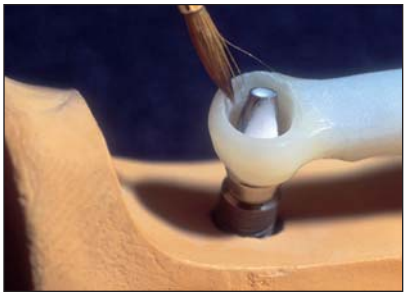

**Fig 4b** The Opaquer of the Dentacolor System, which is applied with a brush, works as a bonding agent.

**Fig 4c** The low-viscosity acrylic resin Sinfony can be adapted from a dispenser in 3 to 5 layers of about 1 mm and must be cured by light polymerization in 15 seconds per layer.

**Fig 4d** The occlusal aspect of the transfer device after finishing: only 1 easily visible area is exposed to control the correct position of the transfer device (first vertical reference).

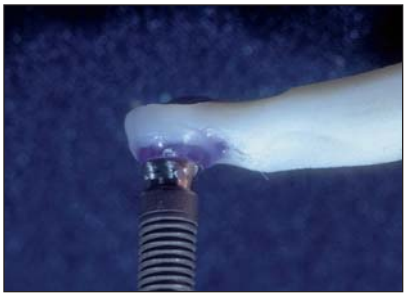

**Fig 4e** The abutment is fixed to the implant replica in final position: one can see the 3 new control areas from the apical view.

cured for 15 seconds. Polymerization of all layers will be complete after 90 seconds. This is followed by 15 minutes in a light-curing oven (Figs 4c to 4e).

The transfer device can be removed easily from the modified angled abutment by finger strength because of its conical shape and the chosen material combination.

This procedure is followed by a direct waxup of the framework for the porcelain-fused-to-metal or solid metal crown or prosthesis and its fabrication (without prefabricated components). Then, the position transfer of the angled abutment with the correct and final seating can be realized via the transfer device. Finally, the crown or prosthesis can be seated.

## RESULTS

The main advantages of this treatment are the reduced number of components (1 to 5) and patient appointments (Table 1). The choice of insertion path and preparation of the abutment can be realized better extraorally.

### Precision

For greater accuracy of the transfer device the angled abutment has to be prepared by the technician. This leads to a simplified procedure for position control and transfer. The seat itself has a definite position and improved precision.

**Table 1 Comparison of the Standard Protocol to the Proposed Method[5]**

| Standard protocol | New method |
|---|---|
| Appointment 1 | |
| 1. Healing abutment | 1. Healing abutment |
| Appointment 2 | |
| 2. Angled abutment | 2. Implant impression transfer or implant impression pickup |
| 3. Healing cap, angled | 3. Implant replica |
| Appointment 3 | |
| 4. Angled abutment pickup | 4. Angled abutment |
| 5. Angled abutment replica | 5. Incorporation of the single crown via screw |
| 6. Semi burn-out cylinder, angled or titanium cylinder, angled | |
| Appointment 4 | |
| 7. Incorporation of the single crown via screw | |

### Control

The modified angled abutment needs an individual transfer device. The existing palatal indexing feature is insufficient. After the abutment is connected to the transfer device and then to the implant, the final position can be controlled in the mouth by visual access at 5 reference points.

### Material

Spectra Tray material is very hard and it is easy to handle. The Opaquer fluid allows the materials to bond. Sinfony has a very low shrinkage rate and is also easy to handle. The blue and white materials provide good contrast.

Although the stability is very high, the material can be changed and adapted if necessary in little time.

### Practicability

This 1-piece transfer device integrates all abutments for a 1-step try-in procedure. Only in cases of great divergence (> 30 degrees) should the abutment of the most divergent implant for a multiunit reconstruction be inserted first. This results in 1 path of insertion for the whole superstructure. However, minimum play horizontally and vertically between the fixed abutments and the superstructure is unavoidable because of the cast inaccuracy, not because of transfer inaccuracy.

### Time and Costs

One appointment, 2 components, and about 23.5% of the component costs for 1 crown can be omitted. The new technique can provide a transfer device for a quarter of the time and cost required in the past.

## DISCUSSION

The use of modified standard implant elements can provide flexibility in clinical situations involving implants placed in nonparallel inclinations.[6] The advantage of only 1 healing abutment is the undisturbed healing and natural contouring of the soft tissue for maximal esthetics. No component for the protection of the top cone and the internal threads of the angled abutment during restorative treatment is necessary.

Selection of the optimal rotational position and the correct prosthetic axis is too important to determine during the appointment. The experienced technician working with the master cast can successfully find the best suitable position and modify the angled abutment. If necessary, the technician can use a parallelometer to create 1 path of insertion for the entire suprastructure.[7] If 2 implants are placed early as a substitute for 2 roots of 1 molar tooth, they provide an enlarged implant-to-bone contact as an alternative to late placement of a wide-diameter implant.[8]

Different materials and methods may be used in the laboratory. The fabrication of a transfer device made of an autopolymerizing acrylic resin (Palavit-G, Heraeus-Kulzer, and Pattern Resin, GC, Aichi, Japan) has to be done with a brush in very small layers because it is liquid. This procedure takes about 20 minutes for 1 implant and as long as 80 minutes for 4 implants. This can be expensive. According to Judy,[9] the cast nonprecious alloy abutment transfer driver is difficult to alter both in the laboratory and at the chair because it is too hard and it cannot be repaired or changed easily. The time to fabricate and the price are higher than with resin materials. One driver for 1

implant is used, so each is very small. There is also the danger of accidental aspiration. The correct final rotational position is only indicated by an arrow pointing facially. Any reference point and the possibility for controlling the position are missing. There can be poor precision of the definitive prosthesis because there must be too much play to use it as a cementing guide. Little time saving can be realized because only 1 abutment can be seated at a time. Whether an abutment transfer device is necessary if the implant is free standing is debatable.

Judy's clinical implications apparently refer to implants with an external or internal hexagon connection because it is necessary to address the problems of soft tissue displacement and entrapment, stripping, or damaging of the internal threading and of abutments that need cementation. These implants have rotational discrepancies caused by the design of the implant-abutment interface. One advantage of the described abutment transfer driver occurs when a 1-piece abutment cannot be manipulated effectively by the wrench or seating device supplied by the manufacturer because it has been shortened or altered. In this case the driver can be used for application of the abutment but not for its transfer or control.

## CONCLUSIONS

The method proposed in this article improves quality control for the practical use of existing components with different application. Modifications of the angled abutment can be done in minimal time. Fabrication of this individual transfer device is quick and easy using a new combination of materials. The chair time and the number of components are minimized, and the clinical results are generally predictable and result in lower costs.

## ACKNOWLEDGMENTS

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