

# A TECHNIQUE FOR PROSTHETICALLY ALIGNING MULTIPLE NON-PARALLEL IMPLANTS

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## ABSTRACT

**AIM AND OBJECTIVE:** A device was designed to be used together with a dental surveyor to determine the proper abutment angle combination in cases with multiple non-parallel implants.

**BACKGROUND:** Anatomical and technical difficulties may lead to unfavorable implant positioning and/or alignment. Angled abutments can be used to properly align non-parallel implants. Determining the required abutment angulation can be challenging especially with multiple implants.

**TECHNIQUE:** An implant level impression is made and poured. Long impression posts are screwed onto the implant analogs to determine implant alignment. The cast is placed over the device platform that is placed over a dental surveyor. The angulation between implants is determined by aligning the long impression posts to the analyzing rod of the surveyor and the implant angulation is measured using the device.

**CONCLUSION:** This simple device determines the angle between multiple implants to achieve a common path of insertion for splinted multiunit restorations.

**KEYWORDS:** Abutment angle determination; dental implants; unparallel implants; angular deviation.

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## INTRODUCTION

Placing implants in a proper prosthetic position and direction is essential to achieve a successful long-lasting restoration.<sup>1</sup> However, this is sometimes difficult to achieve because of anatomical or technical difficulties and angled abutments are required to correct the unfavorable alignment.<sup>2,3</sup> Angled abutments can either be custom made or prefabricated.<sup>2,3</sup> When custom made abutments are used, proper abutment angulation can be achieved by using either conventional techniques or a computer aided design software.<sup>4</sup> Prefabricated abutments whether screw or cement retained are provided in different angles to be selected according to implant angulation.<sup>5</sup> Selection of proper abutment angulation can be performed by using trial abutments that are provided in different angles by some companies to be tried on a cast or intraorally.<sup>6</sup>

Challenging situations arise when multiple nonparallel implants are to be restored. The selection of the proper combination of abutment angles to ensure a single path of insertion for a

splinted restoration becomes a challenge. Attempts have been made to measure the angle between adjacent implants using panoramic x-rays or by digital photographs and plane geometry.<sup>7</sup> However, the angle was only determined in 2 dimensions.<sup>1,8</sup> Accurate measurements have also been made by using cone beam computed tomography scans. However, this necessitates exposing patients to unnecessary doses of radiation.<sup>8-11</sup> This article presents a simple technique for determining the prosthetic angle of single or multiple implants for appropriate abutment selection. A device was designed and fabricated to aid in this procedure.

## TECHNIQUE

1. The abutment angle determining device (ADD) consists of a platform 10 cm in length and 8 cm in width mounted on 4 legs, each 5 cm in length. The platform has a horizontal top verified by a water balance scale. It carries a rotating base that moves in a hinge motion. On one side of the platform, a protractor is attached with its 0-mark corresponding to the top surface of the hinged base. The base

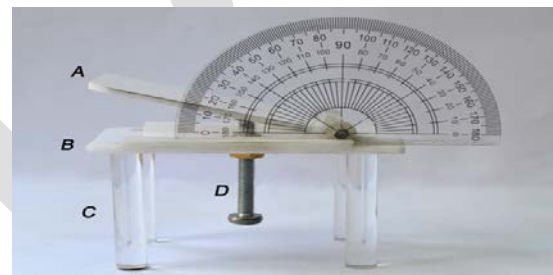
moves in an upward and downward hinge motion by clockwise rotation of a screw (4.5 cm in length) passing through the lower surface of the device platform (Fig. 1)

2. An implant level impression was made and poured by using dental stone. Long impression coping posts were attached to the implant analogs as seen in Fig. 2. The most properly aligned implant (R) was selected in relation to the rest of the teeth in partially edentulous situations or in relation to the rest of implants in edentulous cases. The implant (R) was considered the reference to which the other implant angulations were correlated and measured (Fig. 3)
3. The cast was positioned on the movable base of the ADD. The base is set at the zero mark of the protractor by rotating the bottom screw completely in an anticlockwise direction.
4. The ADD was placed over the surveying platform of the surveyor (Ney surveyor; Dentsply International Inc.). An analyzing rod was attached to the tool holder (Fig. 4)
5. The base of the cast was trimmed to align the long axis of the reference implant (R) to be parallel to the analyzing rod in mesiodistal and buccolingual directions (Fig. 5)
6. To measure the angle between the rest of the implants and the reference implant (R) in a mesiodistal direction, the cast was aligned on the ADD so that the facial or lingual surface of the neighboring implants were parallel to the inner surface of the protractor. The analyzing rod was located on the mesial or distal sides of the post (Fig. 6)
7. The device was moved slowly over the surveying platform without changing the cast alignment until the long post of the second implant approached the analyzing rod. The facial or lingual surface of the implants were kept parallel to the inner surface of the protractor to ensure making the measurement on the same anteroposterior plane (Fig. 6)
8. If the implant to be aligned was mesially inclined, the cast was positioned so that the anterior implants faced the free movable end of the rotating base. If the implant to be measured was distally inclined, the cast was positioned on the ADD so that the posterior implants faced the free movable end of the rotating base and the lingual surface of the implants were parallel to the inner surface of the protractor (Fig 6 )
9. The base screw was rotated in a clockwise direction to elevate the base rotating in a hinge fashion until the long post on the implant to be aligned became parallel to the analyzing rod of the surveyor. The angle formed by the base on the protractor was checked and recorded. This number represents the

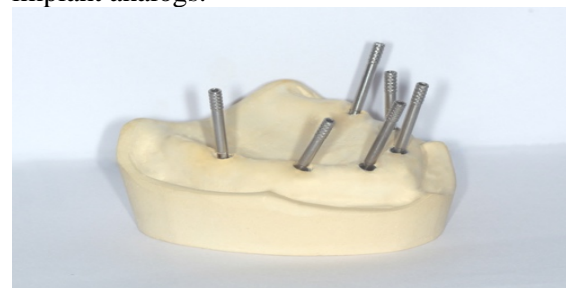
angle of the second implant in relation to the reference implant (R) in the mesiodistal direction (Fig. 7)

10. The same steps were followed to measure the angle between both implants in a buccolingual direction. The cast on the ADD was rotated so that the mesial or distal surface of the implants faced the protractor and the measurements were made (Fig. 8)
11. If the implant was aligned at a position between the mesiodistal and buccolingual direction (mesiolingually inclined for example), the device measured the angle at any direction in 360 degrees around the implant by rotating the ADD device over the surveyor platform and still aligning the impression post parallel to the analyzing rod.
12. After measuring all implant angles, a straight abutment was attached to the reference implant (R), and the corresponding abutment angles were chosen for the rest of the implants and screwed on the cast to achieve a common path of insertion for the restoration (Fig. 9)

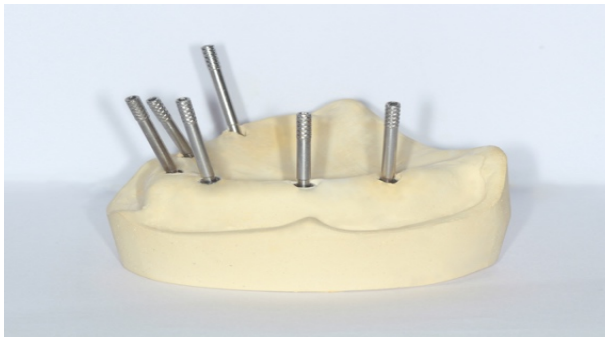
**Figure 1.** Abutment angle determining device. A, Base. B, Platform. C, Legs. D, Screw.



**Figure 2.** Impression coping posts attached to implant analogs.



**Figure 3.** Most properly aligned implant (R) in relation to the rest of implants.



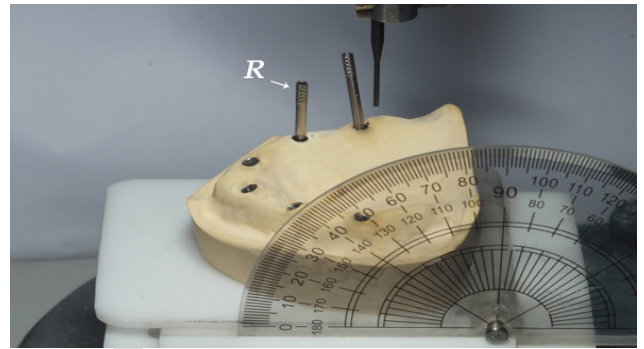
**Figure 4.** Full measuring apparatus setup. Analyzing rod attached to tool holder.



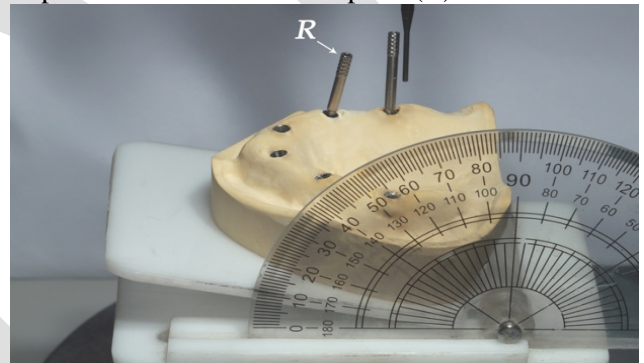
**Figure 5.** The long axis of the reference implant (R) aligned to be parallel to the analyzing rod



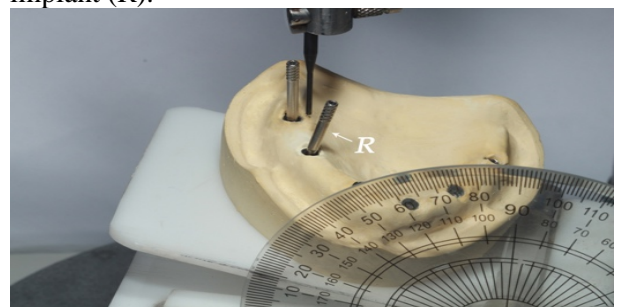
**Figure 6.** Analyzing rod placed distal to the impression post (of the mesially inclined implant) and the angle formed between the base and platform of the device on the protractor is zero.



**Figure 7.** The ADD device base is rotated till the impression post of the implant to be measured is parallel to the analyzing rod. Note the angle (11 degrees) formed by the base on the protractor denoting the angle between the implant and the reference implant (R).



**Figure 8.** Angle between reference implant (R) and neighboring implant in a mesiodistal direction. Note the angle (14 degrees) formed by the base on the protractor denoting the angle between the implant and the reference implant (R).



**Figure 9.** A straight abutment is attached to the reference implant (R) and angled abutments corresponding to implant

angulations attached to the rest of implants to achieve a common path of insertion.



## DISCUSSION

Determining implant inclination in various planes and directions is imperative especially during the prosthetic phase where angulation correction can be achieved by properly selected angled abutments.<sup>2,3</sup> Conditions can become challenging especially when multiple non-parallel implants need to be splinted in a single restoration.<sup>6,7</sup> The proposed device can measure the implant angle at any direction and relate it to a reference .

The advantage of the technique is that it can be used with any implant system to provide an objective estimation of single or multiple implant angulations. The proposed device can measure the implant angle 360 degrees around the implant, not only in 2 dimensions. Screw or cement retained angled abutments can be selected accordingly .

The device can also be used to determine the need to prepare prefabricated straight preparable cement retained abutments if the angle between multiple implants is greater than the standard abutment taper. It also provides an easily accessible method that might eliminate the need for an abutment selection kit provided by some implant systems. The current technique can also be used for research purposes to accurately position single or multiple implant replicas in study casts at specific angulations and positions.

The limitations of the present technique involve the need to manufacture the ADD. The measured angle might not be as accurate as digital techniques; however, it gives an accurate estimate to select the desired abutment angle .

## CONCLUSION

This article describes a simple technique for determining the prosthetic angle of implants. It can also be used to select the proper combination of angles to achieve a common path of insertion for splinted multiunit restorations .

**COMPLIANCE WITH ETHICAL STANDARDS**  
**FUNDING**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector. It was completely self-funded.

## CONFLICT OF INTEREST

None

## ETHICAL APPROVAL

This is an invitro technique that does not necessitate an ethical approval

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