



Comparison of the scan data accuracy using implant scanbody and scan healing abutment



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Introduction

The development of digital equipment and dental materials have made digital dentistry available in clinical practices. In the field of implant dentistry, the use of CAD-CAM technology to fabricate implant prostheses has become popular in the last decade, and the workflow can be either direct or indirect depending on whether an intraoral scanner and an intraoral scan body or a laboratory scanner and a conventional impression coping. While scanbody serves the same function as conventional impression taking, the scan healing abutment simultaneously achieves the functions of healing abutment and impression coping to allow intraoral scanning in the fabrication of implant prosthesis. The purpose of this study is to compare the accuracy of scan images using scan healing abutment with the scanbody for implant digital impressions.

Materials and Methods

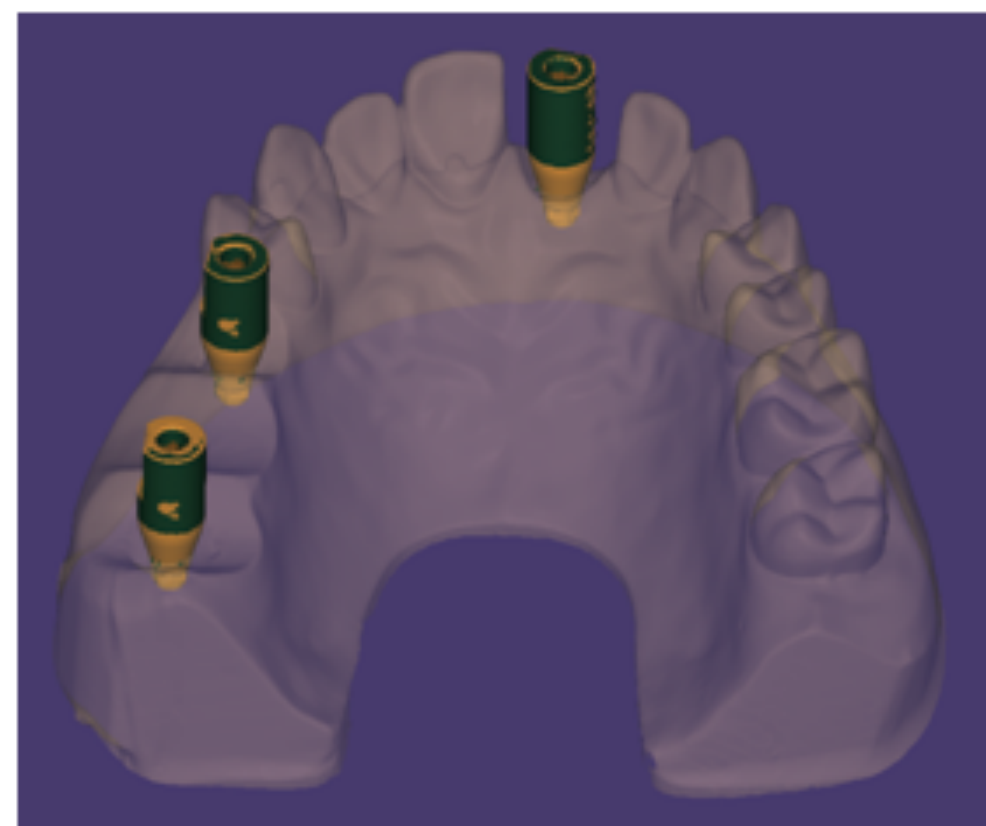
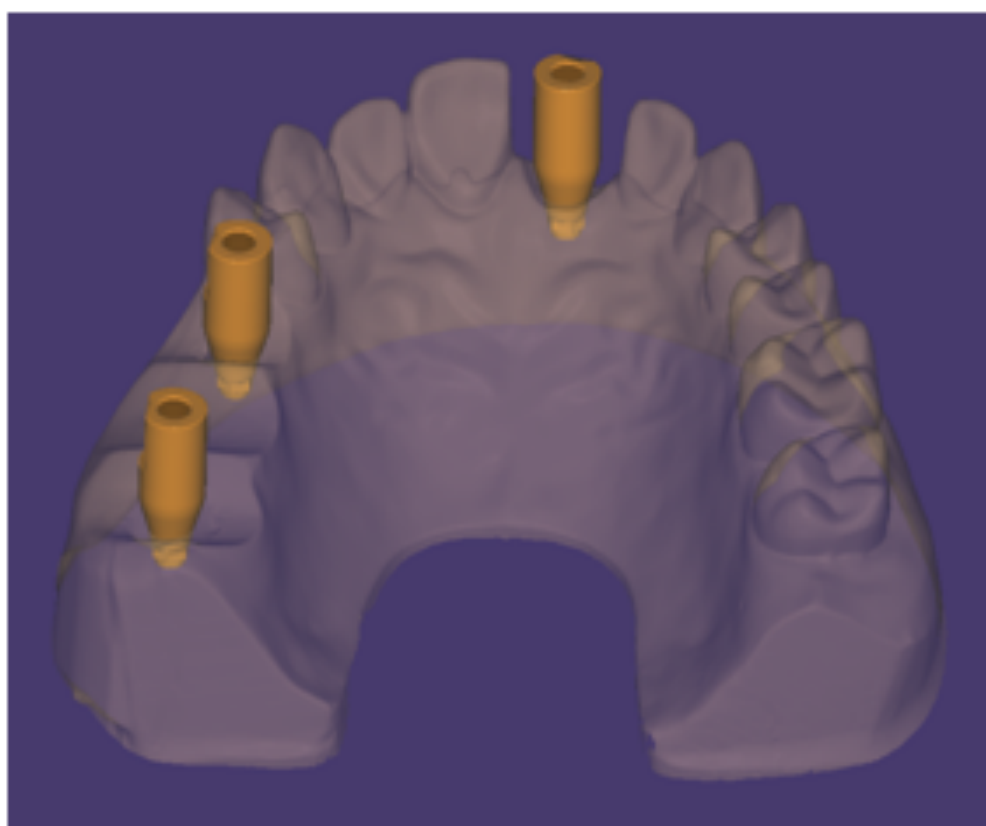
Model Fabrication



3D printed resin model with the digital laboratory analogue (Neobiotech, Seoul, Korea) on #15,17,21 was fabricated.

Data acquisition

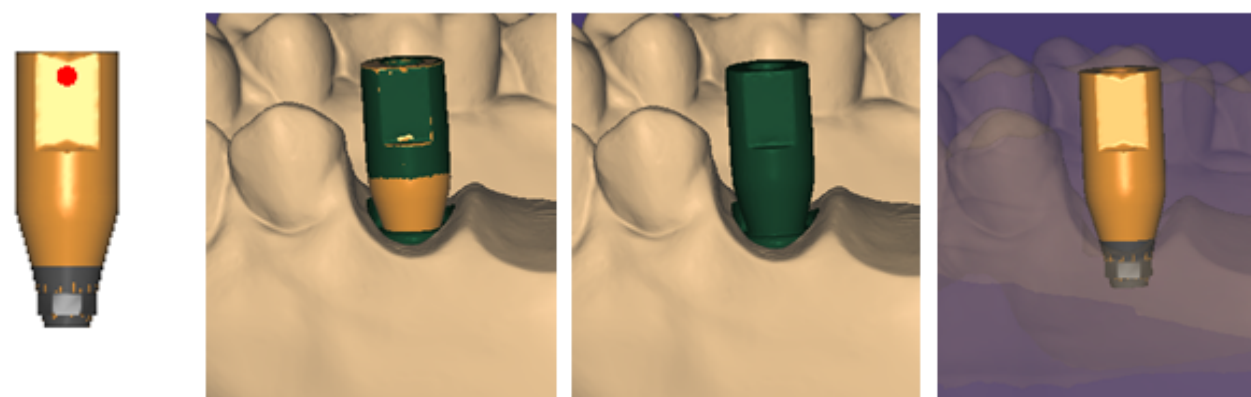
1. Reference data acquisition



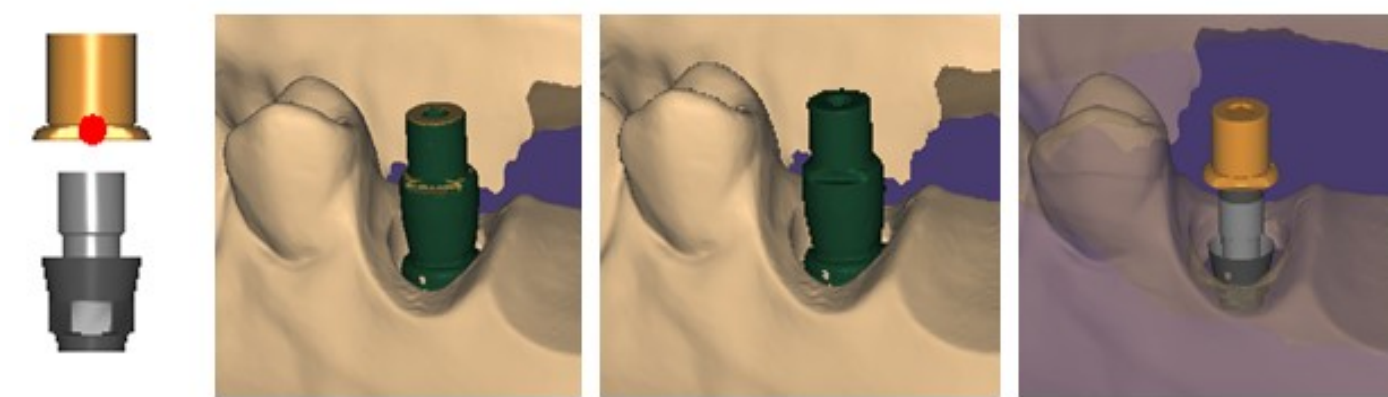
After scanbody (IS D5, Neobiotech, Seoul, Korea) was connected to the model on #15i, #17i, and #21i, it was scanned with the model scanner (Medit Identica Hybrid, MEDIT Co., Seoul, Korea) and the element hex was created using Exocad (Exocad GmbH, Darmstadt, Germany).

2. Experimental data acquisition

The scan data were obtained using a Trios® (3Shape Dental Systems, Copenhagen, Denmark) intraoral scanner. Scanning was performed and repeated 20 times. All scanned data were converted into an STL file



Scanned with scanbody (IS D5 Neobiotech, Seoul, Korea), 5.0 mm in diameter and 14.1 mm in length

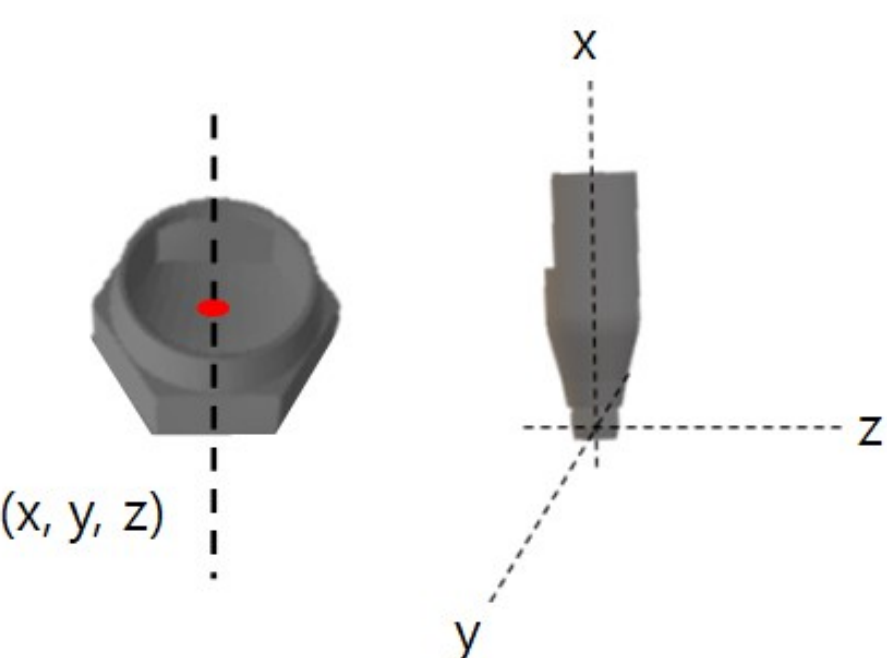
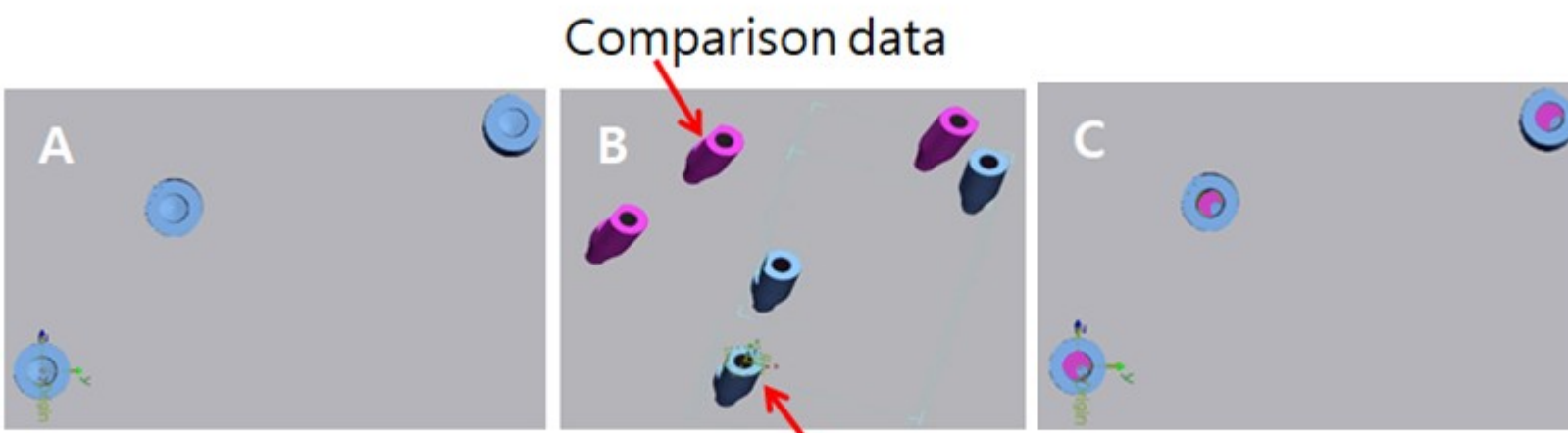


Scanned with scan healing abutment (IS 4004S, Neobiotech, Seoul, Korea), 4.0 mm in diameter and 4 mm in length,

Calculation of Data coordinates and distances

Geomagic® Control X (3D Systems, Rock Hill, South Carolina, USA) was used to compare the scan data of scanbody and scan healing abutment, with the reference data. The x, y and z coordinates were set at the center of the #17i hex of the reference, and the coordinates for #15i and #21i were derived and set as the reference coordinates. Data obtained from scanning with an intraoral scanner were imported with the reference data and aligned by initial and best-fit alignments, after which the coordinate values were derived by setting the same coordinates. The distances between the reference coordinates and the x, y and z coordinates for #15i, #17i and #21i were derived, and the distance between the coordinates $\{(x_1, y_1, z_1), (x_2, y_2, z_2)\}$ was calculated as the Euclidean distance.

$$\text{Euclidean distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$



(A) The x,y,z axis is generated at the center of #17i hex of the reference data (B) Blue indicates reference data, and pink indicates comparative data. (C) Initial alignment and best fit alignment by importing comparison data into reference data

Statistical analysis

All statistical analyses were performed using R 3.6.2 (R Foundation, Vienna, Austria). Two-way analysis of variance was performed to compare the two types of digital impression copings and intraoral tooth positions. In addition, an independent t-test was performed to investigate the differences between the two types of impression copings. The significance level was set at 0.05.

Results

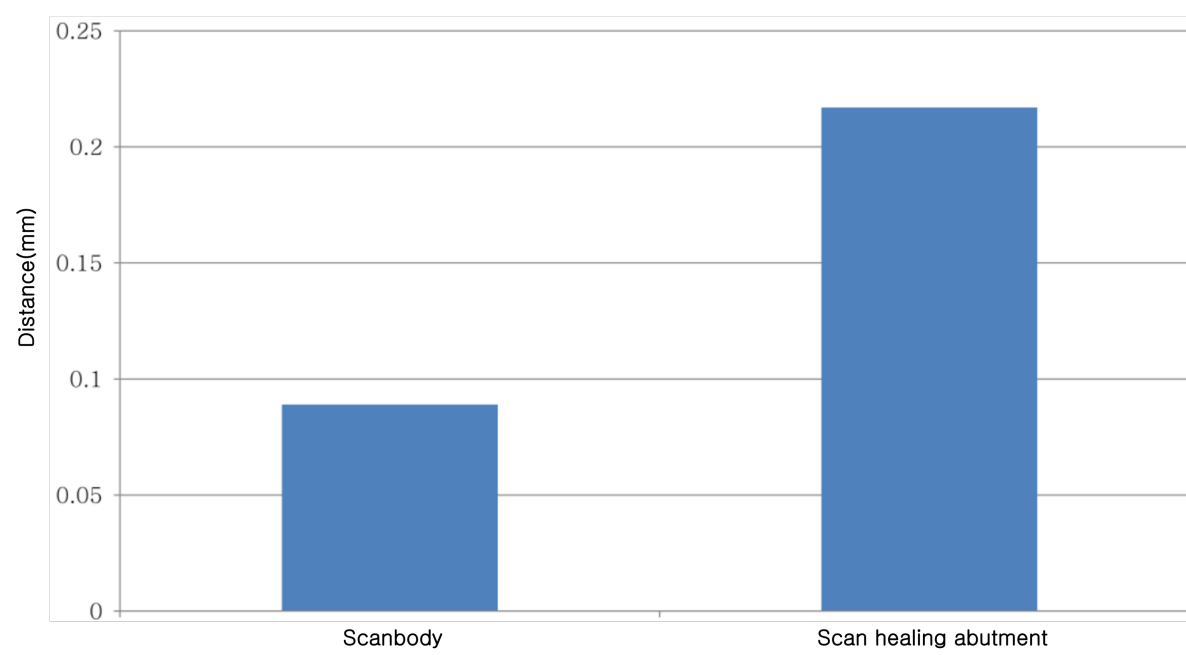
1. Effect of the intraoral position

The mean distance at #15, #17, #21 was 0.067mm, 0.135mm, 0.064mm for scanbody group, and 0.299mm, 0.199mm, 0.153mm for scan healing abutment group. However, result have shown that there were no significant differences in distance depending on the tooth location ($p=0.1315$).

2. Effect of the types of digital impression coping

The mean distance from reference point was 0.089mm for the scanbody group and 0.217mm for the scan healing abutment group. Therefore, the scanbody appeared closer to the reference value than the scan healing abutment.

Group	Intraoral position	N	Mean±SD
Scanbody	15	20	0.067±0.045
	17	20	0.135±0.032
	21	20	0.064±0.057
Scan healing abutment	15	20	0.299±0.368
	17	20	0.199±0.141
	21	20	0.153±0.139



Conclusion

- There was no significant difference according to intraoral position for both scanbody and scan healing abutment groups.
- The accuracy of scan data was higher with the scanbody than with the scan healing abutment.

References

- Oh KC, Kim JE, Kim JY, Shim JS. A review of the digital impression taking technique of implants by using a coded healing abutment. *Implantology* 2017;21:128-136.
- Rutkūnas V, Gečauskaitė A, Jeglevičius, Vaitiekūnas M. Accuracy of digital implant impressions with intraoral scanners. A systematic review. *Eur J Oral Implantol* 2017;101-120.
- Kim KR, Seo KY, Kim SJ. Conventional open-tray impression versus intraoral digital scan for implant-level complete-arch impression. *J Prosthet dent* 2019;122(6):543-54