Accuracy of implant-supported crowns fabricated by additive and subtractive manufacturing technology using ceramic-filled resins

Yolanda Natali Raico Gallardo[a], PhD; Gabriel Nima, PhD[b]; Jorge Noriega, MSc[c]; Cortino Sukotjo, PhD[d]

[a]Assistant professor, Department of Prosthodontics, University of Pittsburgh, PA

[b]Assistant professor, Department of Biomedical Sciences, Ethics, Research and Education, Universidad de los Andes, Chile

[d]Professor, Speciality in Periodontics and Implantology, Universidad de Ciencias Aplicadas, Peru

[c]Professor and Chair, Department of Prosthodontics, University of Pittsburgh, PA

University of Pittsburgh

INTRODUCTION

- Additive manufacturing (AM) has emerged as an alternative for fabricating implant-supported crowns. However, concerns remain regarding its accuracy when used with prefabricated abutments featuring complex retentive geometries.
- The purpose of this in vitro study was to compare the accuracy, defined as trueness and precision, of subtractive manufacturing (SM) and two AM methods (DLP and SLA) for the fabrication of single implant supported crowns.

MATERIAL AND METHODS

Additive vs. **Subtractive**

DLP

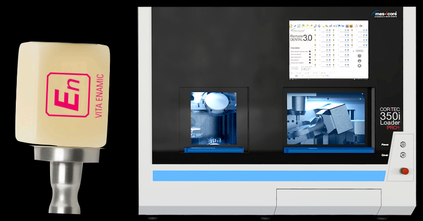
SprintRay

Pro55S

SLA

FormLabs

Form 3B+



350i Loader PRO

imes-icore

Accuracy of implant-supported crowns fabricated by additive and subtractive manufacturing technology using ceramic-filled resins

Yolanda Natali Raico Gallardo[a], PhD; Gabriel Nima, PhD[b]; Jorge Noriega, MSc[c]; Cortino Sukotjo, PhD[d]

University of Pittsburgh

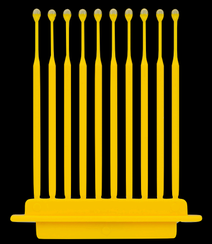
MATERIAL AND METHODS

Printed specimen

Milled specimen

Variobase® RC-Straumann

DATA ACQUISITION



OptraStick® -Ivoclar

45 Specimens

Digitized by an intraoral scanner

Trios 4-3Shape

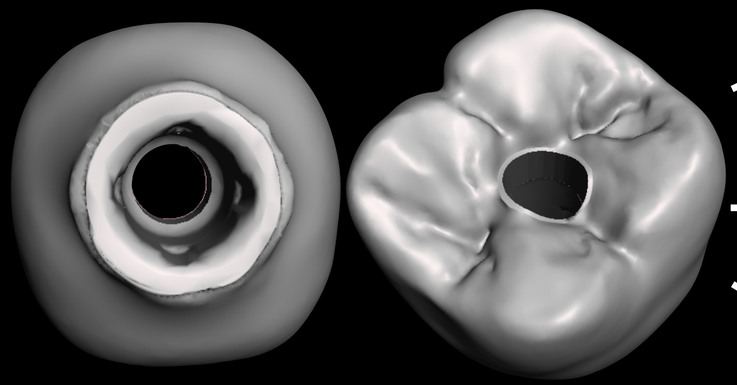
Accuracy of implant-supported crowns fabricated by additive and subtractive manufacturing technology using ceramic-filled resins

Yolanda Natali Raico Gallardo[a], PhD; Gabriel Nima, PhD[b]; Jorge Noriega, MSc[c]; Cortino Sukotjo, PhD[d]

University of Pittsburgh

MATERIAL AND METHODS: DATA ANALYSIS

CAD Design



Control STL

15 STL files (DLP group)

15 STL files (SLA group)

15 STL files (Milled group)

Geomagic-Control X

45 Comparisons

Accuracy of implant-supported crowns fabricated by additive and subtractive manufacturing technology using ceramic-filled resins

Yolanda Natali Raico Gallardo[a], PhD; Gabriel Nima, PhD[b]; Jorge Noriega, MSc[c]; Cortino Sukotjo, PhD[d]

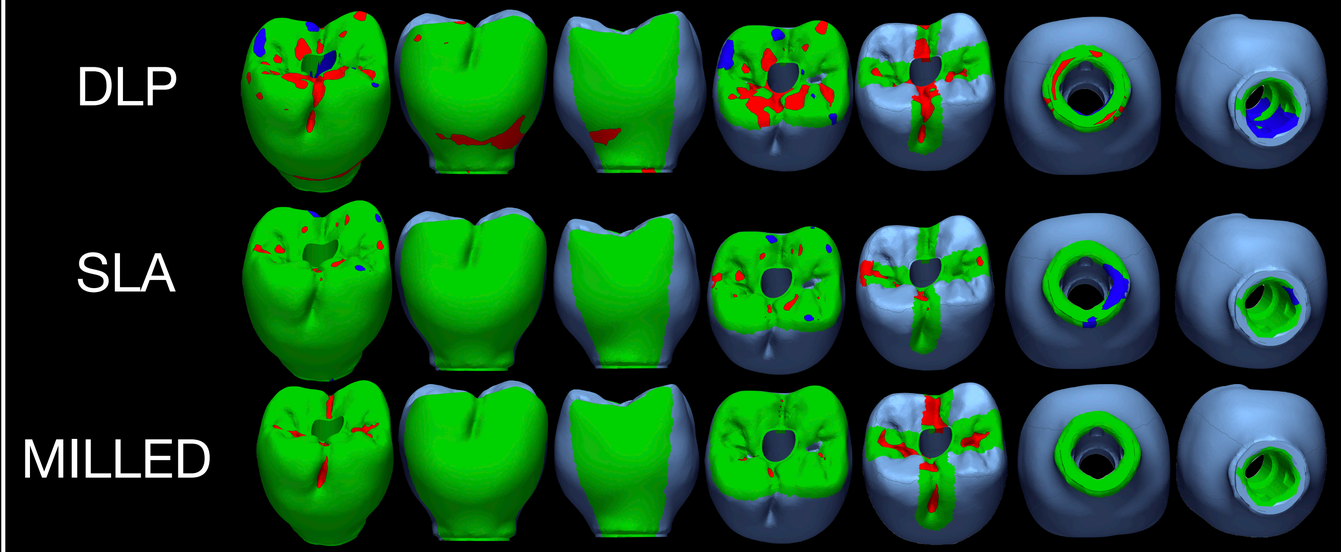
University of Pittsburgh

RESULTS

Group	Trueness (*μ*m)	Precision (μm)
MILLED	41.97 ± 2.52 A	39.49 ± 4.12 A
SLA	50.45 ± 4.91 B	46.52 ± 5.42 B
DLP	81.21 ± 5.86 C	77.19 ± 5.15 C

*Groups sharing the same superscript letter are not significantly different (Welch's ANOVA and Games Howell's post-hoc test ; p > 0.05)

*Previously reported clinically acceptable thresholds for implant-supported restorations, approximately 160 μm for vertical misfit and 150 μm for horizontal misfit.[1]



Green areas = minimal deviation

Red areas = positive deviation (overcontoured surface)

Blue areas = negative deviation (undercontoured surface)

Accuracy of implant-supported crowns fabricated by additive and subtractive manufacturing technology using ceramic-filled resins

Yolanda Natali Raico Gallardo[a], PhD; Gabriel Nima, PhD[b]; Jorge Noriega, MSc[c]; Cortino Sukotjo, PhD[d]

University of Pittsburgh

CONCLUSION

- Milled crowns demonstrated superior accuracy and may be preferred when precise fit and optimal peri-implant adaptation are critical.

- DLP demonstrated the lowest overall accuracy and the greatest deviations at the marginal regions.

REFERENCES

1. Abdelrehim A, Etajuri EA, Sulaiman E, Sofian H, Salleh NM. Magnitude of misfit threshold in implant-supported restorations: A systematic review. J Prosthet Dent 2024;132:528-35.

2.Ioannidis A, Pala K, Strauss FJ, Hjerppe J, Jung RE, Joda T.Additively and subtractively manufactured implant-supported fixed dental prostheses: A systematic review. Clin Oral Implants Res 2023;34:50-63 .

3.Nima G, Ratzeburg FSG, Manrique Z, Mukai E, Bechtold TE, Gallardo YNR. Accuracy of additive and subtractive methods for interim tooth-supported restorations: An in vitro comparison of occlusal, axial, and intaglio surfaces. J Prosthet Dent 2025;134:408.e1-408.e8.

4.Revilla-León M, Fry E, Supaphakorn A, Barmak AB, Kois JC. Manufacturing accuracy of the intaglio surface of definitive resin-ceramic crowns fabricated at different print orientations by using a stereolithography printer. J Prosthet Dent 2025;133:505-11.