Accuracy of a direct drill-guiding system with minimal tolerance of surgical instruments used for implant surgery: a prospective clinical study

Du-Hyeong Lee[1], Seo-Young An[2], Min-Ho Hong[3], Kyoung-Bae Jeon[4], Kyu-Bok Lee[1]*

[1]Department of Prosthodontics, School of Dentistry, A3DI, Kyungpook National University, Daegu, Republic of Korea
[2]Department of Oral and Maxillofacial Radiology, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea
[3]Department of Bio-medical Research Institute, A3DI, Kyungpook National University Hospital, Daegu, Republic of Korea
[4]Department of Prosthodontics, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea

PURPOSE. A recently introduced direct drill-guiding implant surgery system features minimal tolerance of surgical instruments in the metal sleeve by using shank-modified drills and a sleeve-incorporated stereolithographic guide template. The purpose of this study was to evaluate the accuracy of this new guided surgery system in partially edentulous patients using geometric analyses. **MATERIALS AND METHODS.** For the study, 21 implants were placed in 11 consecutive patients using the direct drill-guiding implant surgery system. The stereolithographic surgical guide was fabricated using cone-beam computed tomography, digital scanning, computer-aided design and computer-assisted manufacturing, and additive manufacturing processes. After surgery, the positional and angular deviations between planned and placed implants were measured at the abutment level using implant-planning software. The Kruskal-Wallis test and Mann-Whitney U test were used to compare the deviations (α=.05). **RESULTS.** The mean horizontal deviations were 0.593 mm (SD 0.238) mesiodistally and 0.691 mm (SD 0.344) buccolingually. The mean vertical deviation was 0.925 mm (SD 0.376) occlusogingivally. The vertical deviation was significantly larger than the horizontal deviation (*P*=.018). The mean angular deviation was 2.024 degrees (SD 0.942) mesiodistally and 2.390 degrees (SD 1.142) buccolingually. **CONCLUSION.** The direct drill-guiding implant surgery system demonstrates high accuracy in placing implants. Use of the drill shank as the guiding component is an effective way for reducing tolerance.
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KEY WORDS: Accuracy; Guided surgery; Dental implants; Tolerance; Surgical drills

INTRODUCTION

Appropriate placement of dental implants is essential for esthetic and restorative aspects.[1,2] The development of computer-assisted guided surgery has helped realize restoration-driven implant placement.[3] Contemporary guided implant surgery systems are generally based on cone-beam computed tomography (CBCT) and computer-aided design and computer-assisted manufacturing (CAD/CAM) technologies. CBCT visualizes anatomic structures without superimposition, which enables 3-dimensional (3D) diagnosis and treatment planning.[4-6] CAD/CAM technologies improve the fabrication of surgical guides by reducing manual work and facilitating transfer of the planned implant position to the guide template.[7] Accurate placement of implants makes it possible to deliver restorations to the

Corresponding author:
Kyu-Bok Lee
Department of Prosthodontics, School of Dentistry, A3DI, Kyungpook National University, 2175 Dalgubeoldae-ro, Jung-gu, Daegu 41904, Republic of Korea
Tel. 82536007674: e-mail, kblee@knu.ac.kr
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