

# A Simple Three-Dimensional Guide for Safe Miniscrew Placement

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**M**iniscrews are small enough to be inserted into narrow spaces that could not be used with endosseous implants, such as the alveolar bone between the roots of adjacent teeth.<sup>1-18</sup> Miniscrew placement in these sites can be challenging, however, because of the risk of root damage.<sup>19-26</sup>

In a previous report, Suzuki and Buranastidporn described the use of a fully adjustable guide that provides three-dimensional control during miniscrew placement.<sup>22</sup> A smaller, improved version of this device, the 3D Surgical Guide,\* has now been developed (Fig. 1). The present article describes how the new device can be used to identify ideal miniscrew positions, minimizing the risk of root injury.

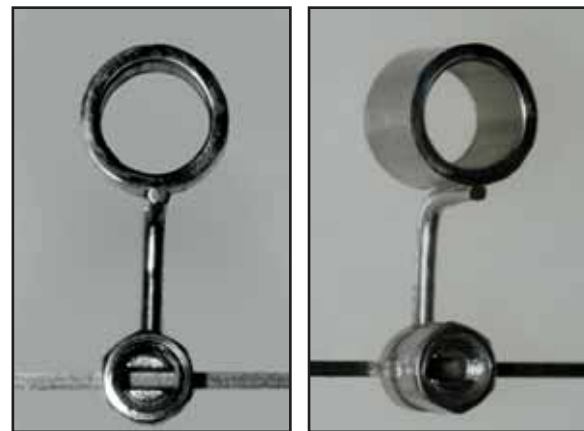


Fig. 1 3D Surgical Guide is attached to archwire and adjusted as needed.

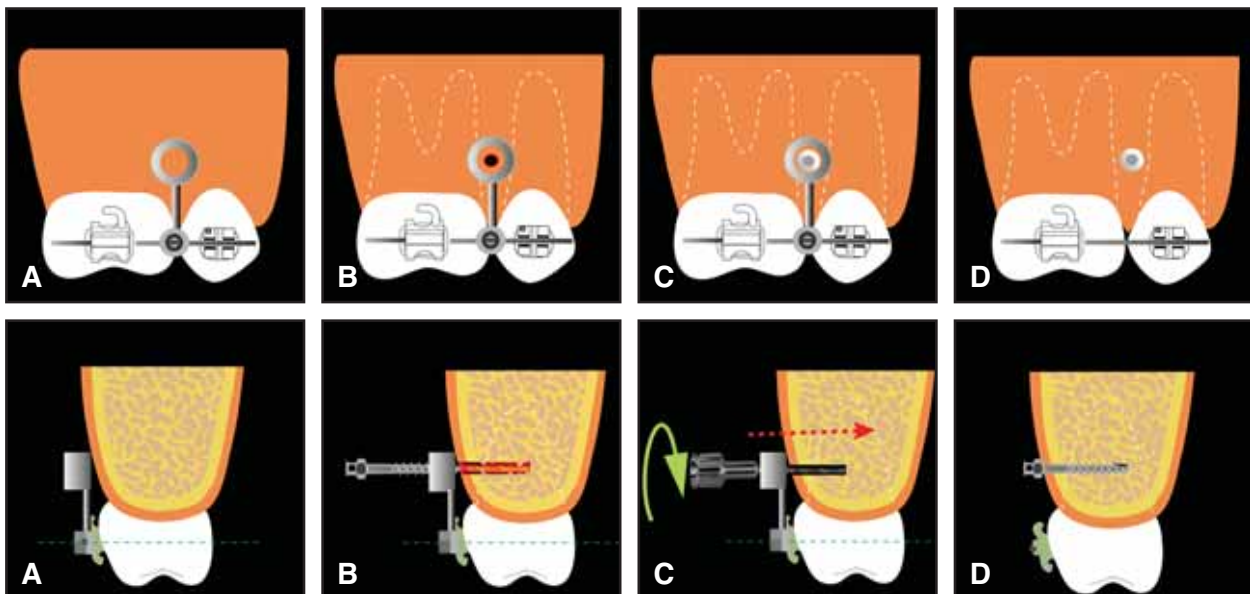


Fig. 2 Miniscrew insertion using 3D Guide. A. Identification of optimal implant site. B. Drilling of pilot hole through guide tube. C. Insertion of miniscrew. D. Removal of guide.

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### 3D Surgical Guide

The 3D Guide is available with a vertical arm length of 5mm, 7mm, or 9mm. One end of the arm is attached to the main orthodontic archwire with a Gurin lock; the other is connected to a stainless steel tube 5mm long and 3mm in diameter. The tube is used to identify the optimal implant site on bite-wing radiographs and to guide the drilling of the pilot hole and placement of the miniscrew (Fig. 2). The device's simple design and range of sizes allow easy and rapid attachment at any position along a maxillary or mandibular stainless steel or

nickel titanium archwire, with either labial or lingual appliances (Fig. 3). A manual screwdriver is used to adjust the guide outside or inside the mouth.

Fine adjustments can be made in the horizontal position of the guide tube to achieve ideal miniscrew placement in relation to surrounding structures (Fig. 4). Adjustments can also be made in the angulation of the tube to alter the miniscrew insertion angle and thus increase the surface contact between miniscrew and bone<sup>4,22,26</sup> (Fig. 5).

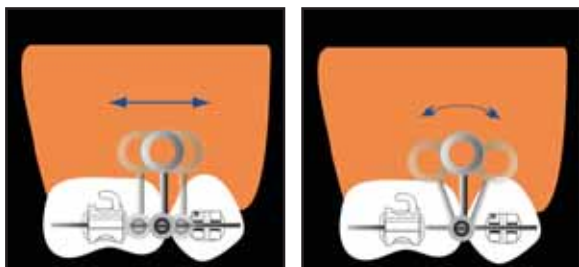
### Miniscrew Insertion Procedure

Using conventional elastomeric impression material, take a bite registration on the plastic tab of a custom-made bite-wing film

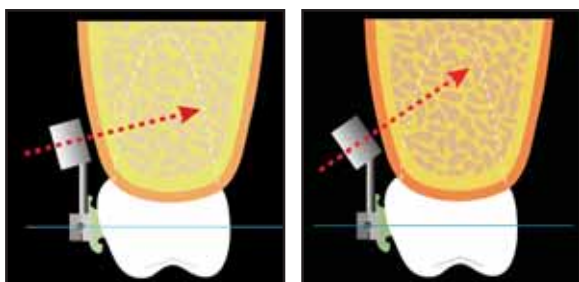
\*Y&B Products, LP, Huay Keaw Soi 3, Amphur Muang, Chiang Mai 50200, Thailand; www.yb-products.com.



Fig. 3 3D Guide in various archwire positions. A. Maxillary anterior region. B. Mandibular anterior region. C. Maxillary posterior region. D. Mandibular posterior region. E. Lingual appliance.



**Fig. 4** Fine horizontal adjustments made by repositioning 3D Guide on archwire.



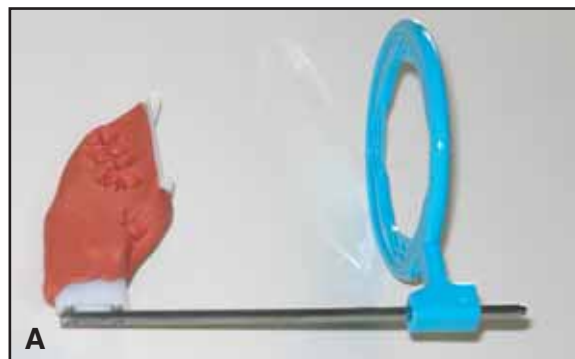
**Fig. 5** Fine adjustments made in tube angulation to alter miniscrew insertion angle and increase surface contact between miniscrew and bone.

holder\*\* (Fig. 6A). This makes it possible to obtain consistent radiographs of the implant site throughout the placement procedure. The long-cone technique is used to minimize distortion and standardize the distance from the film to the x-ray tube (Fig. 6B).

Position the 3D Guide as accurately as possible at the preselected implant site (Fig. 7A). Take a radiograph to determine whether the radiopaque tube is correctly positioned to ensure the safety of the surrounding structures (Fig. 7B). If not, adjust the guide and take successive radiographs until the ideal position is achieved.

With the guide in the optimal implant position, drill a pilot hole, using normal saline irrigation to avoid excessive heat generation and remove bone debris (Fig. 7C). Insert the miniscrew into the pilot hole through the guide tube with the custom-

\*\*Rinn XCP film holding system, Dentsply Rinn, 1212 Abbott Drive, Elgin, IL 60123; www.rinncorp.com.



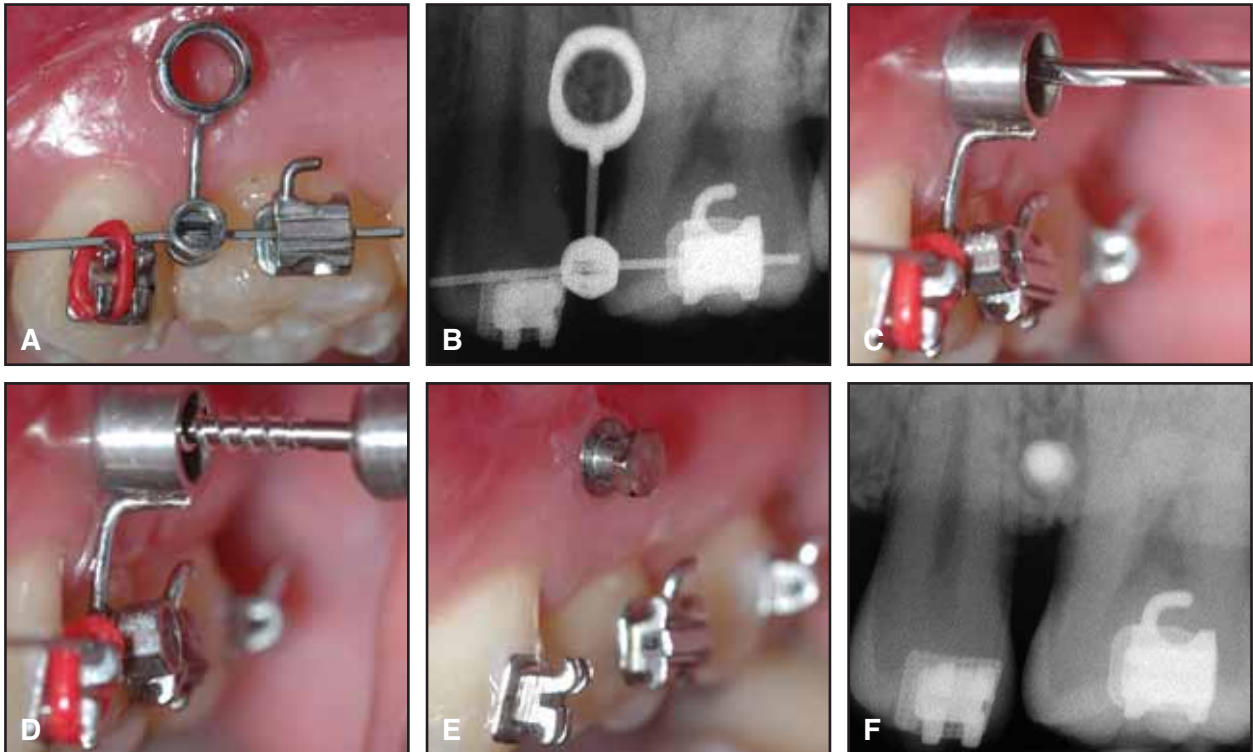
**Fig. 6** A. Bite registration taken on custom-made film holder to ensure precise positioning of film at implant site. B. Vertical bite-wing radiograph taken using long-cone technique.

made manual screwdriver (Fig. 7D). Once the screw is in place, gently remove the 3D Guide with the screwdriver. If necessary, screw the implant further to secure it in the bone, taking care not to jeopardize its primary stability (Fig. 7E).

Take a final bite-wing radiograph of the implant site to confirm proper positioning of the miniscrew (Fig. 7F). This x-ray also serves as a pre-treatment record.

## Discussion

A variety of techniques have been proposed to minimize the risk of root damage from interdental miniscrews. A custom-made wire guide can be a practical radiopaque marker,<sup>10</sup> but it provides only limited, two-dimensional information on the implant site.<sup>22</sup> Furthermore, because it does not



**Fig. 7** A. 3D Guide in position. B. Bite-wing x-ray with image of radiopaque guide used to determine optimal miniscrew position relative to surrounding structures. C. Pilot hole drilled through guide tube. D. Miniscrew inserted through guide tube into pilot hole. E. Miniscrew in place after removal of guide. F. Final radiograph with miniscrew in place.

prevent deviation of the pilot drill, it does not eliminate the risk of root damage.<sup>26</sup> Surgical stents,<sup>20,21,24,27</sup> guides,<sup>22,23,26</sup> and templates<sup>25,28-30</sup> can transfer a radiographically planned, three-dimensional implant position to the surgical site more accurately, but fabrication of these guides is complicated and time-consuming, requiring laboratory equipment. Moreover, such devices do not allow the orthodontist to perform the fine clinical adjustments that may be needed to ensure precise miniscrew placement.

The 3D Guide described here solves many of these problems. It is easy to use, versatile, and fully adjustable for use in any position along the archwire of a labial or lingual appliance in either arch. Fine adjustments can be made to achieve an ideal miniscrew position in relation to the surrounding structures, alter the angle of miniscrew insertion,

and maximize the surface contact between implant and bone. The guide can easily be removed from the archwire after miniscrew placement and reused on the opposite side, saving chairtime and expense. Patient discomfort is minimal.

In a previous retrospective study, we found that the accuracy of miniscrew placement with the 3D Guide was significantly greater than that achieved with a wire guide or no guide.<sup>26</sup> Regardless of the guide method used, however, radiographic assessment is critical. Vertical bite-wing x-rays taken with the long-cone technique can pinpoint the optimal miniscrew position in relation to surrounding structures, while a custom-made film holder ensures precise positioning of the film at the implant site and makes it possible to obtain a standardized series of radiographs throughout the insertion procedure.

ACKNOWLEDGMENTS: The authors are grateful to Dr. M. Kevin O'Carroll, Professor Emeritus of the University of Mississippi School of Dentistry and Faculty Consultant at Chiang Mai University Faculty of Dentistry, for his assistance in the preparation of the manuscript. We also thank Y&B Products for providing the 3D Surgical Guides.

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