

A Precise Wire Guide for Positioning Interradicular Miniscrews

HYUNG-JOO CHOI, DDS, MSD
TAE-WOO KIM, DDS, MSD, PHD
HYE-WON KIM, DDS, MSD

Advantages of miniscrews over endosseous implants in cases requiring skeletal anchorage include their smaller size and lower cost, a wider range of implantation sites, ease of insertion and removal, the ability to load forces immediately, and rapid healing. Caution must be exercised during miniscrew placement, however, to avoid damage to nearby anatomical structures such as roots, nerves, and blood vessels. Contact with a root or the periodontal ligament may not only damage these structures, but also result in miniscrew mobility and failure.

Many techniques have been used to facilitate safe placement of interradicular miniscrews.¹ Brass wires² or metallic markers^{3,4} are easy to place in the interproximal spaces, but because their relative positions may be inconsistent in different radiographic views, they are not always accurate (Fig. 1).

This article introduces a new wire guide (Kim's Stent), a three-dimensional method of positioning miniscrews that avoids root damage and improves the insertion success rate.

Fabrication and Use of Wire Guide

With the archwire removed, take an impression that includes the vestibule, and pour a cast for fabrication of the wire guide. To minimize play in an .022" bracket,* use .0215" × .028" stainless steel wire,** which is rigid enough to resist deformation. The wire guide consists of two parts: a positioning gauge, attached to the tooth distal to the miniscrew placement site, and a directional guide, attached to the tooth mesial to the miniscrew (Fig. 2).

Weld five to seven 2-3mm lengths of .014" Elgiloy*** wire to the horizontal arm of the posi-



Fig. 1 Even if brass wire is appropriately positioned (right), radiograph will not be accurate enough for precise miniscrew placement.



Fig. 2 Kim's Stent for miniscrew placement (P = positioning gauge; D = directional guide).

Dr. Choi is a resident, Dr. Tae-Woo Kim is Professor and Chairman, and Dr. Hye-Won Kim is a graduate student, Department of Orthodontics, School of Dentistry, Seoul National University, Yeonkun-Dong 28, Jongno-Ku, Seoul 110-768, Korea. E-mail Dr. Tae-Woo Kim at taewoo@snu.ac.kr.



Dr. Choi



Dr. T.W. Kim



Dr. H.W. Kim

tioning gauge at 1mm intervals (Fig. 3A,B). Bend the vertical arm so that the gauge extends apically about 3mm past the intended miniscrew position (Fig. 3C). Make a bayonet bend at the mesial opening of the first molar buccal tube to act as a stop, taking care not to contact the second molar bracket (Fig. 3D).

Use the pretreatment periapical radiograph as a reference to bend the directional guide on the working cast (Fig. 4). The occlusal arm determines the direction of miniscrew insertion. After fitting the two parts of the wire guide in the mouth,

take another periapical radiograph to show the position of the roots in relation to the stent. The occlusal arm should be perpendicular to the lower border of the x-ray film, so that the x-ray beam is parallel to the occlusal arm of the directional guide.

On the radiograph, determine the midpoint between the two adjacent roots, based on the wire segments welded to the horizontal arm of the positioning gauge. Using a mirror to visualize the occlusal surface, insert the miniscrew 2-3mm occlusal to the horizontal arm, keeping the screwdriver parallel to the occlusal arm of the directional guide (Fig. 5).

*MBT, trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016; www.3Munitek.com.

**Jinsung Industrial Co., Ltd., 137-1, Ojeon-dong, Uiwang-si, Gyeonggi-do 437-819, Korea; www.smawire.com.

***Trademark of Rocky Mountain Orthodontics, 650 W. Colfax Ave., Denver, CO 80204; www.rmortho.com.

Case 1

This patient's first miniscrew was placed using only the pretreatment radiograph as a guide.

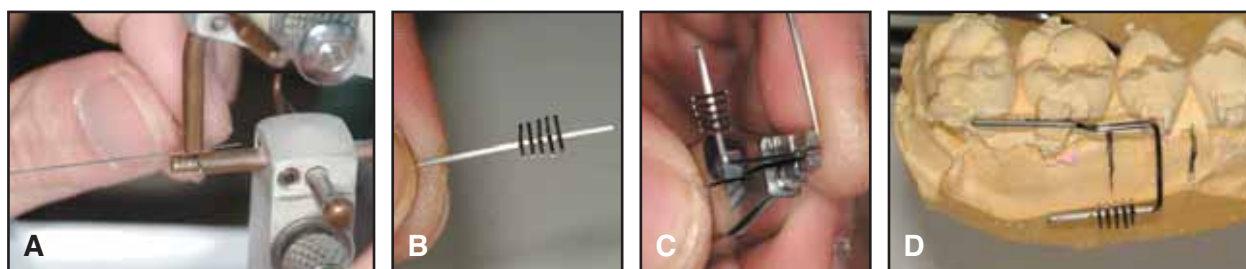


Fig. 3 Fabrication of positioning gauge. A. Five to seven segments of .014" Elgiloy wire welded to .0215" x .028" stainless steel wire at 1mm intervals. B. Wire segments cut to lengths of 2-3mm. C. Vertical arm bent so that gauge extends apically about 3mm past intended miniscrew position. D. Bayonet bend made at mesial opening of first molar buccal tube to act as stop, taking care to avoid second molar bracket.



Fig. 4 Directional guide fabricated on cast, with occlusal arm indicating direction of miniscrew insertion.

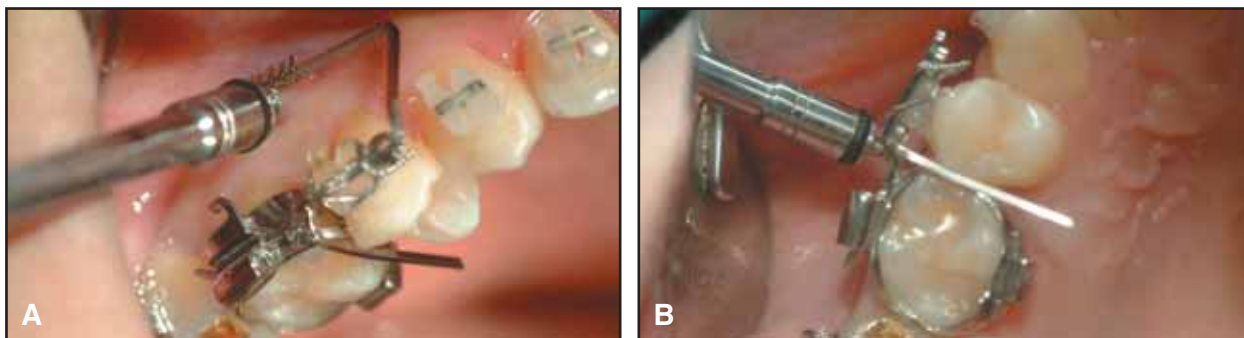


Fig. 5 A. Miniscrew inserted 2-3mm occlusal to horizontal arm of positioning gauge. B. Screwdriver held parallel to occlusal arm of directional guide.

Radiographs taken at different angles showed the screw contacting the adjacent root's periodontal membrane (Fig. 6A). One week after orthodontic loading, the miniscrew loosened and failed. Following two weeks of bone healing, Kim's Stent was used to determine the exact direction and position of reimplantation (Fig. 6B). The miniscrew was inserted midway between the third and fourth wire segments on the horizontal arm of the positioning gauge. A radiograph taken after reimplantation showed a good position between the roots (Fig. 6C).

Case 2

The space for miniscrew placement between the roots of the upper premolars was extremely narrow in this patient (Fig. 7A). After Kim's Stent was fabricated and a periapical radiograph taken, the positioning gauge showed that the interradicular space was less than 3mm (Fig. 7B). The directional guide was perpendicular to the occlusal surface and, therefore, exactly parallel to the x-ray beam. Even with the roots in such close proximity, the miniscrew was safely inserted (Fig. 7C).

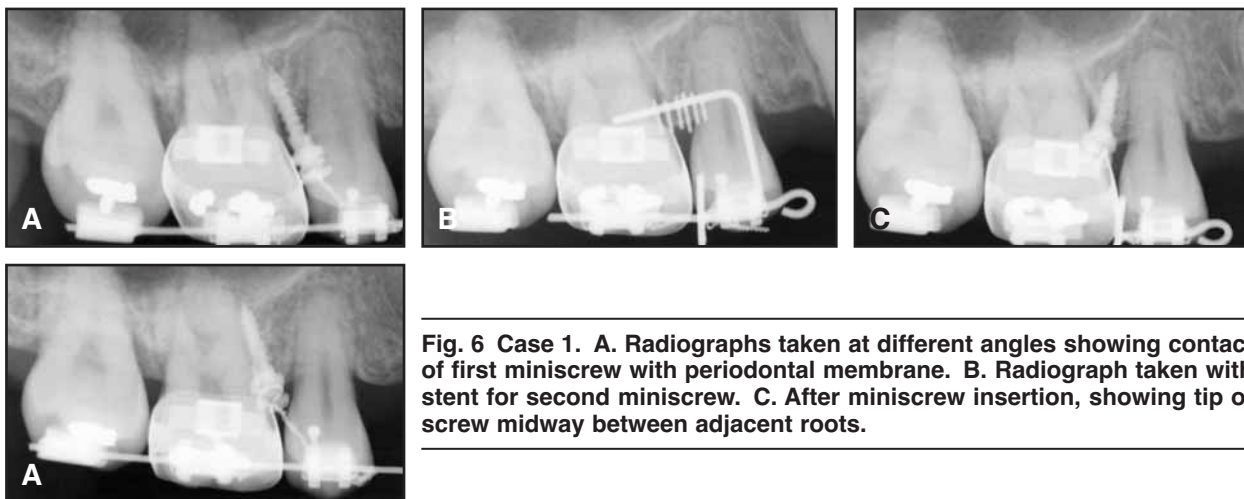


Fig. 6 Case 1. A. Radiographs taken at different angles showing contact of first miniscrew with periodontal membrane. B. Radiograph taken with stent for second miniscrew. C. After miniscrew insertion, showing tip of screw midway between adjacent roots.

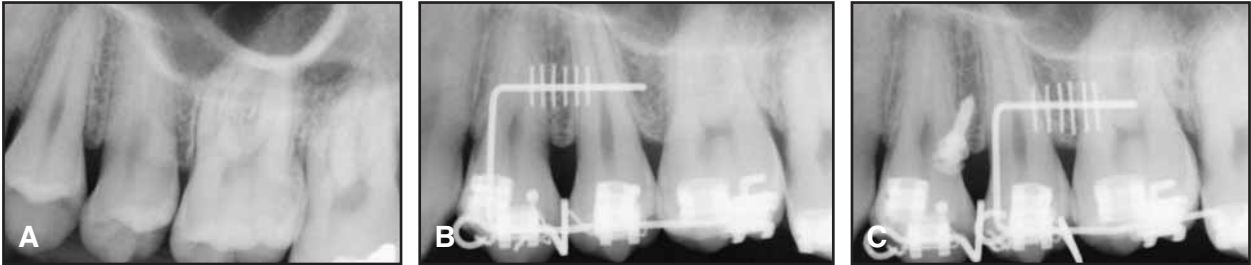


Fig. 7 Case 2. A. Narrow space between roots of upper premolars. B. Radiograph taken with stent in place, showing interradicular space of less than 3mm. C. Miniscrew inserted in space between roots, with second stent for placement of miniscrew between second premolar and first molar.

Discussion

Liou and colleagues found that miniscrews do not always remain stationary after orthodontic force loading, concluding that at least 2mm of clearance is required between a miniscrew and the adjacent roots to avoid trauma to the roots or the periodontal ligament.⁵ Accurate placement can be difficult, especially when the roots are in close proximity.

Kim's Stent is easy to fabricate and inexpensive, and can be used with a variety of miniscrews. Its precise positioning of interradicular miniscrews helps prevent trauma to anatomical structures and thus reduce miniscrew failure rates.

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