A Guide Wire for Miniscrew Placement

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Abstract
Precisely positioning a miniscrew between the teeth to prevent tooth structure damage is one of the important factors for a successful treatment. This article presents an easily-made guide wire that helps positioning the miniscrew between the maxillary second premolar and the first molar with accuracy. The procedures including placing guide wire into the brackets, taking a periapical x-ray film, positioning the miniscrew and controlling the direction of miniscrew insertion are described in this article.

Keywords: miniscrew, guide wire
Introduction

To avoid possible damage to adjacent periodontium and root surfaces, placement of temporary anchorage devices or miniscrews between the teeth should be carried out with care. Some guide wires and x-ray techniques have been proposed for safe location for screw placement. However, a guide wire on the buccal side of teeth only and without control of x-ray orientation may not provide enough information for miniscrew placement. Images from the x-ray with pre-determined direction should display the relation between the roots of adjacent teeth and the relation of those roots to the buccally-placed guide wire. This will guide the clinician not only to locate the point but also to guide the direction for miniscrew insertion. The miniscrew placed at the safe zone between the roots of the teeth in the same direction as the x-ray beam will pass into the alveolar bone without any harm to the periodontium and roots as shown in Figure 1. In the method presented here, the embrasure line between maxillary second premolar and first permanent molar was used as the direction of the x-ray as well as the direction for miniscrew insertion.

The guide wire proposed in this article can help guiding the x-ray direction and indicating the safe area for interproximal screw placement. This guide wire is simple and can be made easily in the office by a clinician.

The safe zone between the second premolar root and the first molar root can be read from the x-ray image. The miniscrew placed in the same direction as the x-ray into the alveolar bone would do no harm to the periodontium and root as shown in Figure 1A and 1B. On the other hand, a miniscrew placed in the bone in a different direction to the x-ray is more prone to injure the periodontium and root as shown in Figure 1C.

Design and Fabrication of the Guide Wire

The guide wire consists of three segmented wires as shown in Figure 2. These three components were tack-welded together using the electric spot welder available in most orthodontic clinics and then soldered.

1. The bracket wire (Figure 2B-1) is made of the 0.016 x 0.022-inch stainless steel wire approximately 20 mm in length. This part is placed in the slot of 0.018 x 0.025-inch bracket. Both ends of this part can also be bent if the molar bracket is used instead of tube.

2. The vertical guide wire (Figure 2B-2) is made of 0.017 x 0.025-inch stainless steel wire approximately 25 mm in length is bent into an L-shape. One vertical end is bent as a buccally-placed guide wire and welded perpendicular to the bracket wire while the occlusal end is placed anteroposteriorly at the embrasure between second premolar and first molar. A half-circle is bent at the upper end of this wire to avoid impingement of a sharp wire end into the muco-buccal fold.

3. The zigzag wire (Figure 2B-3) is made of 0.032-inch round wire. Both ends are parallel to each other and approximately 30 mm apart. The short end is 10 mm long and welded to the
Occlusal part of the L-shape wire (Figure 2B-2). The long free end of this wire is sufficiently long to act as a directional guide for the dental x-ray tube. The tack-welds were reinforced by soldering. The assembly of the three wires is shown in Figure 2A.

**Clinical Application**

The teeth should be aligned before placing miniscrew using this guide wire. The guide wire is placed into bracket slot of second premolar and first molar and secured with the elastic ligature and moved anteroposteriorly until the short end of the zigzag wire is positioned precisely at the embrasure of second premolar and first molar (Figure 3A and B, respectively).

The dental x-ray tube has been aligned parallel to the long end of the zigzag wire extending from the mouth (Figure 4B). The dental film has been placed on the palatal side and held by the patient’s finger (Figure 4A).

The image is then taken in this position. With this method, the image on the film is recorded by the x-ray beam that is projected in the same direction as the short part of the zigzag wire (which is aligned on the embrasure line between second premolar and first molar).

The images of right and left sides are shown in Figure 5A and B. The relation between the roots of the adjacent teeth and the guide wire can now be interpreted for safe location of the miniscrew by comparison of the x-ray image with the position of the guide wire in the patient’s mouth.

The images give the information for the safe areas to place the miniscrews. The short end of the zigzag wire should be imaged as a point or the short vertical line (arrows). The safe area between tooth 15 and tooth 16 is decided as 1 mm posteriorly to the vertical guide wire in Figure 5A, while that between tooth 25 and tooth 26 is exactly at the vertical guide wire in Figure 5B.

After the mucosa disinfection and local anesthesia are applied, the miniscrew position for insertion of each miniscrew is marked by an explorer point level with the highest points of the mucogingival junctions of the adjacent teeth. As noted above, for this patient the mesio-distal position on the right side is 1 mm posterior to the vertical guide wire, and on the left side exactly on the vertical guide wire line as shown in the x-ray images (Figure 5A and B).

After the screw insertion point is marked, the guide wire is removed. A miniscrew is then inserted at the point marked on the gingiva in the direction parallel to the embrasure line between the second premolar and the first molar (which was the same direction as the occlusal/embrasure...
The use of 2D imaging to locate safe area for miniscrew insertion requires that the x-ray beam should be parallel to the direction of screw insertion. With the guide wire introduced in this article, we ensure that the direction of the x-ray will be parallel to the reference line used for screw insertion (that used here being the embrasure line between second premolar and the first molar); the vertical wire image acts as the guide for centering the screw in the safe area of alveolar bone between molar and premolar.

Some clinicians may add vertical wire grids that show both horizontal and vertical relations with the interseptal bone. However, the interproximal space is quite narrow, so that the straight vertical leg should give enough information for the point to insert screw anteroposteriorly, using a horizontal path of insertion following the embrasure line.

For the vertical positioning, the authors follow the recommendation that the miniscrew should be placed on the gingiva, rather than the movable mucosa to avoid inflammation. Therefore the screw would be placed as high as possible on the attached gingiva.

The guide wire presented here can be fabricated with simplicity by clinicians using the spot welder available in most orthodontic offices. This guide wire can also be sterilized and reused.

As it is the clinicians’ responsibility to avoid the complication from the implant insertion following the adage “first, do no harm”, the safe area for the miniscrew placement has to be investigated carefully. In summary, the guide wire described in this report can be useful to locate the point for interproximal miniscrew placement with high accuracy to avoid injury to root surface.

Acknowledgement

Authors would like to show our deep gratitude to Professor Keith Godfrey for his kind assistance and comments that greatly improved the manuscript.
References


