Bonding Orthodontic Attachments to Miniscrew Heads

SEUNG-HYUN KYUNG, DDS, PHD
HAE-WON CHOI, DDS
KYUNG-HO KIM, DDS, MS, PHD
YOUNG-CHEL PARK, DDS, PHD

Miniscrews can be a useful alternative to conventional orthodontic anchorage when the teeth need to be moved in the same direction, when there is insufficient quantity and quality of dental anchorage, or when patient compliance is doubtful. Limitations include the possibility of loosening or failure when the screws are placed in thin alveolar bone or in growing children. Stability can be improved by connecting multiple miniscrews to a miniplate, but these plates require close cooperation with the oral surgeon and separate procedures for insertion and removal.[1,2] Extramucosal screw splinting could be a simpler way to enhance stability.

Another factor to consider when using miniscrews is the application of moments for

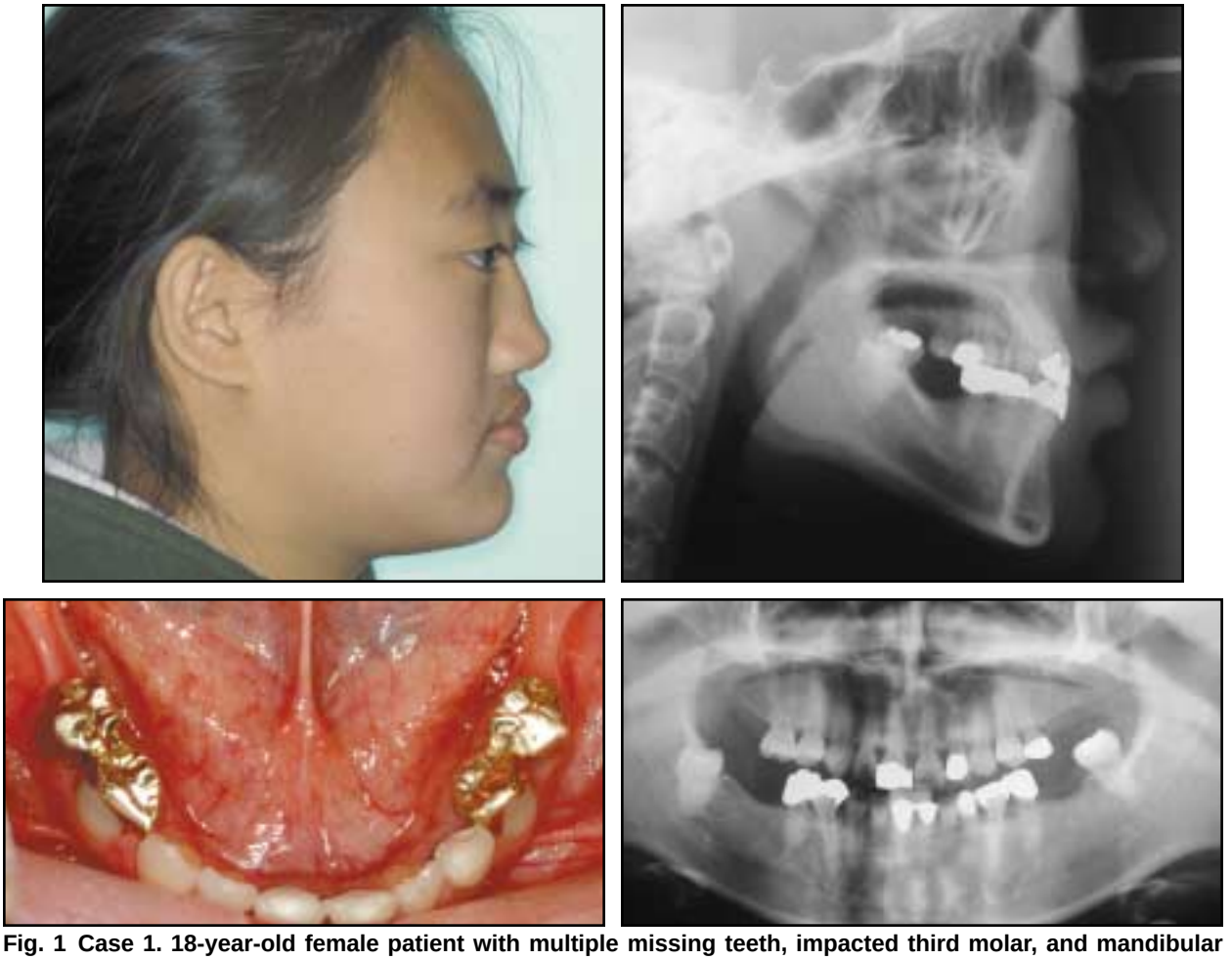

Fig. 1 Case 1. 18-year-old female patient with multiple missing teeth, impacted third molar, and mandibular prognathism before treatment.

Dr. Kyung is an Associate Professor and Dr. Choi is a former Resident, Department of Orthodontics, Institute of Oral Health Science, Samsung Medical Center, 50, Ilwon-Dong, Kangnam-Ku, Seoul 135-710, Korea. Drs. Kim and Park are Professors, Department of Orthodontics, College of Dentistry, Younsei University, Seoul. E-mail Dr. Kyung at kaustin@smc.samsung.co.kr.


Dr. Kyung


Dr. Choi


Dr. Kim


Dr. Park

Fig. 2 Case 1. Placement of miniscrew on edentulous ridge.

various biomechanical force systems. Because a single screw head provides limited options for the attachment of elastics, round tubes[2] and rectangular slots[3] have been built into several designs. If an orthodontic attachment could be bonded directly to the screw head, individualized torque and rotation control could be achieved without unwanted movements of other teeth.

In the following cases, we show the application of moments by bonding different attachments to miniscrews, as well as a splinting method that improves screw stability.

Case 1

An 18-year-old female presented with a missing lower left permanent central incisor and canine, upper right second premolar, and all first and second molars, along with a retained upper right second deciduous molar and lower left deciduous central incisor and canine (Fig. 1).

The prosthodontist recommended mesial movement of the impacted lower right third molar to support a three-unit bridge. The lower anterior teeth could not be used for anchorage due to the patient's Class III pattern, however, so a miniscrew was proposed as an alternative.

A self-tapping miniscrew* (2mm in diameter, 7mm long) was inserted in the edentulous ridge with a slow-speed handpiece** at 30rpm (Fig. 2). Elastic chain was applied for mesial movement of the anterior teeth, but could not be used to deliver a root-mesial moment to the impacted third molar (Fig. 3). Therefore, after 11 months of treatment, brackets were bonded to the miniscrew head and the third molar for insertion

Fig. 3 Case 1. Elastic chain used for mesial movement of anterior teeth.

*Osteomed, 3750 Realty Road, Addison, TX 75001.

**Gebruder Martin Gmbh & Co., K.G. Ludwigstaler Strasse 132, D-78532 Tuttlingen, Germany.

of an appropriate wire segment (Fig. 4). For optimum bond strength, the screw head was sandblasted with 50-micron aluminum oxide particles for 10 seconds, using a Microetcher,*** and a 4-META resin metal primer† was applied.

After another 11 months, the third molar had been erupted and moved 4-5mm mesially without displacement of any other teeth (Fig. 5). The miniscrew remained stable during treatment; two years later, due to financial problems, the patient was still prepared for delivery of the three-unit bridge (Fig. 6).

***Danville Engineering, 2021 Omega Road, San Ramon, CA 94583.

†Panavia, Kuraray Medical Inc., 1621 Sakazu, Kurashiki, Okayama 710-8622, Japan.

Fig. 4 Case 1. Bracket bonded to miniscrew head for application of root-mesial moment.

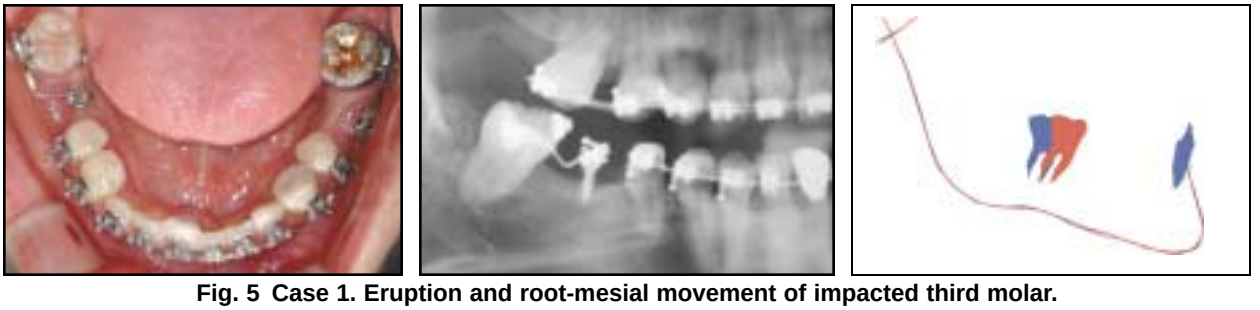

Fig. 5 Case 1. Eruption and root-mesial movement of impacted third molar.

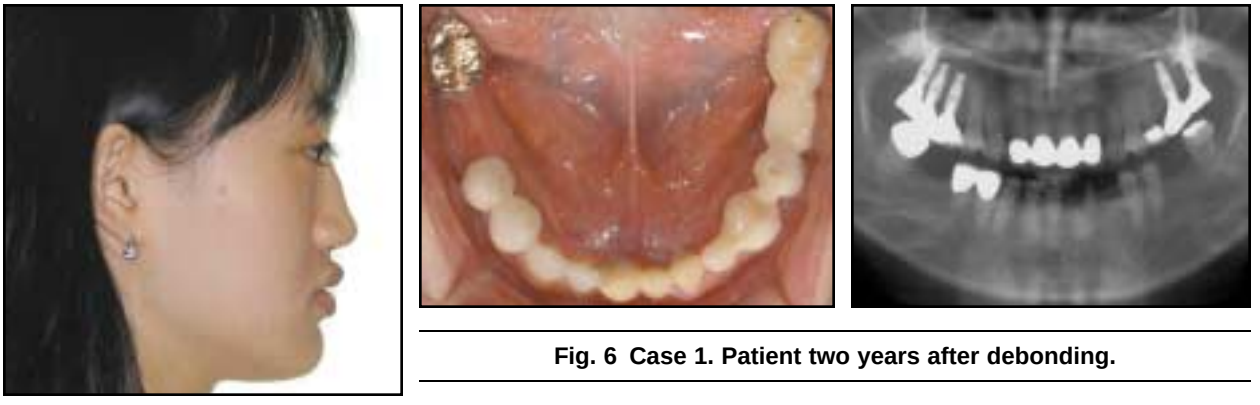

Fig. 6 Case 1. Patient two years after debonding.

Case 2

A 52-year-old female presented with a mesially tilted lower right second premolar root (Fig. 7). The prosthodontist requested that the premolar be uprighted so that stable implants could be used to replace the missing first and second molars.

Miniscrews were inserted in the first and second molar positions (Fig. 8). After sandblasting the screw heads with 50-micron aluminum oxide particles for 10 seconds and applying a metal primer, we splinted the miniscrews together by bonding them to a sandblasted mesh base, which had been welded to a sheath. An extension arm was inserted into the sheath, and derotation of the lower right second premolar was begun with a force couple (Fig. 9).

Five months later, a recurved wire welded to a bracket was inserted into the sheath for root-mesial movement (Fig. 10). After another six months, the root of the second premolar had been moved 4-5mm mesially (Fig. 11). Permanent

Fig. 7 Case 2. 52-year-old female patient with missing lower right first and second molars and mesially tipped lower right second premolar before treatment.

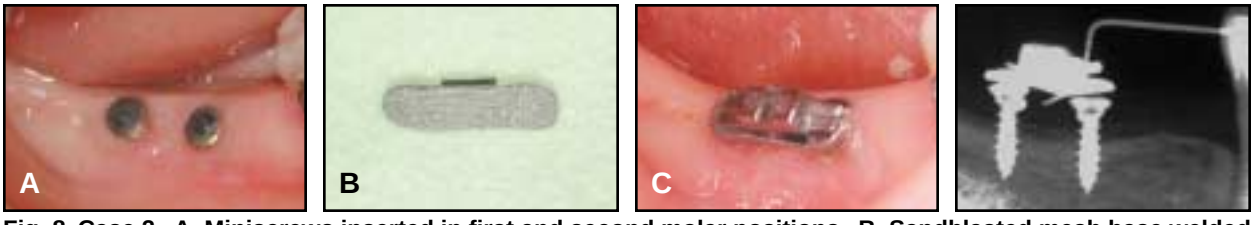

Fig. 8 Case 2. A. Miniscrews inserted in first and second molar positions. B. Sandblasted mesh base welded to sheath. C. Miniscrews splinted together by bonding to metal mesh.

Fig. 9 Case 2. Bucco-lingual extension arm with hook inserted into sheath for application of force couple on rotated second premolar.

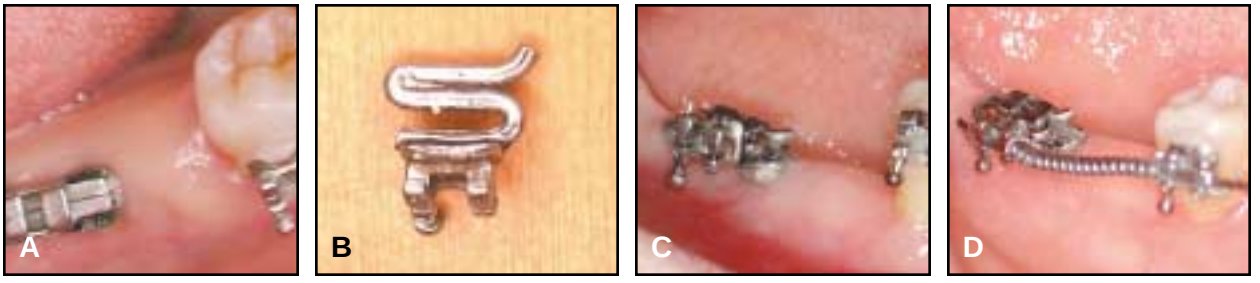

Fig. 10 Case 2. A. Second premolar after derotation. B. Recurved wire welded to bracket. C. Recurved wire inserted into sheath. D. Application of root-mesial moment.

Fig. 11 Case 2. Patient after debonding, showing root-mesial movement of second premolar.

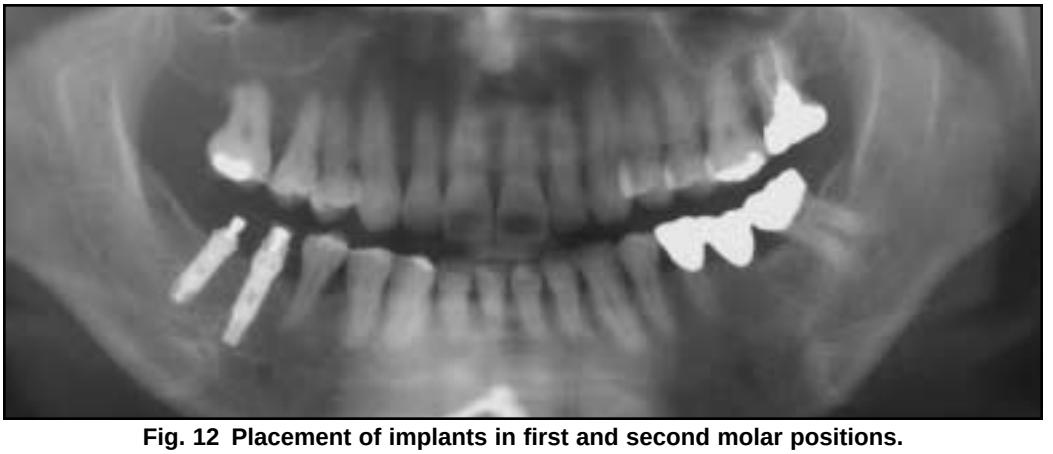

Fig. 12 Placement of implants in first and second molar positions.

implants were successfully installed 13 months later (Fig. 12).

Discussion

To facilitate prosthodontic restoration, orthodontic appliances are typically required in only a portion of the dental arch for a short time. With miniscrew anchorage, the target tooth can be moved selectively without altering the occlusion and with maximum patient comfort and biomechanical efficiency.

Methods for improving the bond strength between metals and enamel have included mechanical undercuts and chemical procedures such as tinfoil-coating,[4] ion implantation,[5] and application of a Ga-Sn solution.[6] Buyukyilmaz and colleagues reported that a combination of sandblasting and treatment with an adhesive agent could increase the bond strength between a bracket and a gold alloy,[7] and metal is comparable to enamel in bonding terms.[8,9] Zachrisson and colleagues also reported increased bond strength to silver amalgam with sandblasting, compared to surface grinding with a diamond bur.[9] The sandblasting provides a microretentive topography over an increased surface area,[10] and the alumina particles remaining after sandblasting may further improve the strength of bonding with a chemically activated monomer.[7]

REFERENCES

1. Umemori, M.; Sugawara, J.; Mitani, H.; Nagasaka, H.; and Kawamura, H.: Skeletal anchorage system for open-bite correction, Am. J. Orthod. 115:166-174, 1999.
2. Chung, K.R.; Kim, Y.S.; Linton, J.L.; and Lee, Y.J.: The miniplate with tube for skeletal anchorage, J. Clin. Orthod. 36:407-412, 2002.
3. Costa, A.; Raffaini, M.; and Melsen, B.: Miniscrews as orthodontic anchorage: A preliminary report, Int. J. Adult Orthod. Orthog. Surg. 13:201-209, 1998.
4. Dixon, D.L.; Breeding, L.C.; Hughie, M.L.; and Brown, J.S.: Comparison of shear bond strengths of two resin luting systems for a base and a high noble metal alloy bonded to enamel, J. Prosth. Dent. 72:457-461, 1994.
5. Tanaka, T.; Hirano, M.; Kawahara, M.; Matsumura, H.; and Atsuta, M.: A new ion-coating surface treatment of alloys for dental adhesive resins, J. Dent. Res. 67:1376-1380, 1988.
6. Gross, M.W.; Foley, T.F.; and Mamandras, A.H.: Direct bonding to Adlloy-treated amalgam, Am. J. Orthod. 112:252-258, 1997.
7. Buyukyilmaz, T.; Zachrisson, Y.O.; and Zachrisson, B.U.: Improving orthodontic bonding to gold alloy, Am. J. Orthod. 108:510-518, 1995.
8. Kern, M. and Thompson, V.P.: Effects of sandblasting and silica-coating procedures on pure titanium, J. Dent. 22:300-308, 1994.
9. Zachrisson, B.U.; Buyukyilmaz, T.; and Zachrisson, Y.O.: Improving orthodontic bonding to silver amalgam, Angle Orthod. 65:35-42, 1995.
10. Kern, M. and Thompson, V.P.: Durability of resin bonds to pure titanium, J. Prosthod. 4:16-22, 1995.